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Developing Children's Cognitive Functions and Increasing
Learning Effectiveness:
An Intervention Using the Bright Start Cognitive Curriculum
for Young Children

By
Kok Siat Yeow

A thesis in partial fulfillment of the
requirements for the degree of
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ABSTRACT

To prepare the young generation for the challenges of a competitive and rapidly changing world, the education systems of Singapore and in many countries in East Asia are focusing on developing children's thinking and learning skills.

This research study examines the effects of a cognitive programme, the Bright Start Cognitive Curriculum for young children, on kindergarten children's cognitive functions and their learning effectiveness. The study adopted an experimental, pretest posttest design with an experimental group of 43 children and a control group of 37 children. The Bright Start Cognitive Curriculum was systematically implemented over a period of six months with the children from the experimental group. The children from the control group had their regular integrated thematic curriculum.

The study used a combination of methods to collect data, involving measurements of children's pre and post tests performances on cognitive tasks, analyses of video recordings of teaching observations and teachers' feedback of children's performances in class.

The findings of the research study suggest that children from the experimental group showed greater improvement in all the cognitive tasks from pre to post testing than the children in the control group. The children's response to mediation scores in the experimental group were positively correlated with their post test scores. The experimental teachers scored higher in all three essential components of Mediated Learning Experience (MLE) than the control teachers; with marked difference between the two groups in the criteria of transcendence. However, the control teachers scored better in affective involvement, which is not one of the essential qualifying components of MLE.

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DECLARATION

This work has not previously been submitted for a higher degree or diploma in a university. To the best of my knowledge and belief, the thesis contains no material, previously published or written by another person, except where due reference is made in the thesis itself.

Signed :

Name : Kok Siat Yeow

Date : 31 January 2011

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CHAPTER 1

INTRODUCTION

“..teaching involves not so much the process of leading students to discover what is ‘out there’ but rather, their discovering what is in their own heads.”

Jerome Bruner, The Relevance of Education (1971)

“A place where people...learn to reason, learn to understand and above all learn to think for themselves.”

Judith (13 years) from Edward Blishen (ed.) The School That I'd Like (1969)

A critical part in the wider field of early childhood development is the area of cognitive development in children. The continuous interplay between the child's unfolding capacities and the environment in which he or she grows up is critical in supporting children's cognitive development. Caregivers, teachers, and quality teaching in the overall programmes in early childhood settings, play important roles in the child's cognitive development and his or her learning.

The interest in recent decades into ways of developing children's thinking and learning skills has been stimulated by research showing new knowledge about how the brain works. Evidence has shown how in the early years of life, children learn, and that specific interventions can improve children's thinking and intelligence (Shore, 1997; Mustard, 2008).

Educators, leaders, policy makers and researchers are calling attention to the importance of teaching thinking skills as part of the curriculum (Feuerstein, Rand, Hoffman & Miller, 1980; Fisher, 1998; Haywood, 2004; Gardner, 1993; Lipman, 1982; McGuinness, 1993). There is a growing consensus that achievement of basic literacy, while obviously necessary, is not a sufficient goal. Children must not only be literate; they must also be nurtured to become competent thinkers.

Singapore, has long prided itself on its efficacious education system, and is well recognised for having produced high levels of academic achievement among students. To meet the challenges of the future and to have an education system geared to the needs of the 21st century, the government realised that it has to focus on developing thinking skills in the people, nurturing a spirit of innovation and the disposition of lifelong learning. The educational context in which this study took place is a changing one. It is slowly shifting from a focus on academic learning to one on developing and teaching thinking skills. Against the background of the implementation of a regular integrated thematic curriculum in childcare centres, the study reported here examined the effects of introducing the Bright Start Cognitive Curriculum to a group of children from 5 to 6 years of age, who formed the experimental group.

1.1 Background of the study

1.1.1 Education in Singapore : The next lap

In 1997, the Ministry of Education's vision of 'thinking schools, learning nation' was first announced by the then Prime Minister Goh Chok Tong at the launch of the Seventh International Thinking Conference held in Singapore. The Government of Singapore realised that thinking skills had to be an integral part of the school's curriculum in order to adequately prepare younger generations of Singaporeans for the challenges of the 21st century. The then Prime Minister, proposed that "thinking schools will be the cradle of thinking students as well as thinking adults and this spirit of learning should accompany our students even after they leave school" ("Thinking schools, learning nation", 2005) and "A learning nation envisions a national culture and social environment that promotes lifelong learning in our people." ("Thinking schools, learning nation", 2005).

Central to this vision, was the concept of schools playing a key role in nurturing future generations of thinking and committed citizens, capable of making good decisions to keep Singapore vibrant and successful in the future ("Singapore's thinking schools of the future", 1997). In the years that followed, large budgets for

resources, information technology, teacher training, curriculum review had been allocated to promote creative thinking in schools.

Another important task of education is to inculcate in students the habit of life-long learning and a passion for learning, instead of just studying for the sake of achieving high test scores. Over the recent years the Ministry of Education has been reviewing its curriculum and assessment system to incorporate the teaching of creative thinking in schools (Nirmala, 1997). In addition, there has been a strong impetus given by the Ministry of Education to nurture a spirit of innovation and enterprise among students. The curricular in schools seek to encourage students to develop key skills for the future which include thinking, communicating and other process skills in all subjects and at all levels (“Establishing a new balance in education”, 2004). The Ministry of Education has repeatedly emphasised the importance of nurturing young Singaporeans to develop inquiring minds. In order to achieve this, the thrust is for Singaporean children to be encouraged to question as they learn, and to experiment with new ways of doing things.

A learning nation where the national culture and social environment promotes lifelong learning in its people, begins by recognizing that education is a continuum, starting in the early childhood years and continuing throughout life (“Vision for a total learning environment – Country’s culture, environment will shape what learning means”, 1997). It has been rightly pointed out that it is important in the early years to develop the dispositions of eagerness to learn and to interact. Recent research on brain development has indicated that the early years in a child’s life are critical for developing the foundations for future intellectual and social development (Shore, 1997; Dipietro, 2000; Mustard, 2008; Wingert & Brant, 2005). Parents, being the primary caregivers of the young child, play an important role in nurturing the child’s development. Hence, working closely with parents to provide their children with rich responsive experiences and making quality preschool education more widely available will contribute towards making Singapore a learning nation

(“Vision for a total learning environment – Country’s culture, environment will shape what learning means”, 1997).

It has been over a decade since the *Seventh International Thinking Conference*. The government appears to have benefited from its investment in promoting thinking in schools judging from the patents awarded to Singapore’s numerous innovations and the reputation it has earned as a research and development hub, attracting renowned international scientists to its shores (Cheam, 2008). In recent years, polytechnics that used to focus mainly on training students and developing applications to industry, are involved in a lot more research, publishing findings and are working on innovations that can be awarded patents (Chua, 2010).

1.1.2 Preschool education in Singapore (from age four to six)

Preschool provision is seen as a responsibility of the government to the children of employed parents. At the same time, in a meritocratic society where academic achievement and success in schools are highly rated aims, parents expect preschools to prepare their children for success in primary schooling (Sharpe, 2002; Wong & Lim, 2002).

Currently, the Ministry of Community Development, Youth and Sports (MCYS) is responsible for the licensing of services for the care of infants and children from two months to approximately seven years of age in the country. The licensing requirements cover aspects relating to matters of operation; health; nutrition; records and reports; staffing requirements; management of children; and of the curriculum such as learning activities and learning corners.

The Ministry of Education (MOE), on the other hand, oversees kindergartens in Singapore. Kindergartens, are for children from three to approximately seven years of age. Unlike the childcare services which operate on a full day basis, kindergarten programmes are only 2.5 hours in duration. There is a wide range of learning programmes for children from age four to six. Many are adapted from programmes

that have been developed in other countries, their philosophies and teaching methods have been adapted to suit the Singaporean culture and ideals. Currently, there is no accrediting body, or evaluation process that sets and monitors professional standards of early childhood programmes (Wong & Lim, 2002).

Generally, Singaporean parents expect preschools to prepare their children for formal schooling and this has resulted in the development and implementation of more academically oriented programmes that focus on promoting literacy and numeracy skills. However, because of the Government's thrust to present a more balanced educational curriculum to young children and with parents themselves becoming better educated, increasingly more parents look for the preschool curricula that focus on developmentally appropriate practices for young children. Consequently, this change in attitude has given rise to play-oriented programmes as well as programmes that adopt the integrated thematic approach, or those that adopt the project approach.

Despite the Ministry's recommendation for promoting holistic development and learning in young children, the reality is that many preschool centres are still very much focused on preparing children academically to be ready for primary schooling. The concern within Singapore's education system is still very much with passing exams and school achievements. Not only does the school curricula push children to perform well on standardised tests, parents too, put much pressure on young children to learn academic skills, such as reading, writing and numeracy skills, at a young age (Ebbeck & Warrier, 2008). In the light of this, the curriculum in many preschool centres is aimed at developing children's numeracy and literacy skills which they believe, will help the children to acquire the content knowledge for learning in primary school. Not surprisingly then, there is a flourishing enterprise of reading and math programmes, known as 'enrichment' programmes on offer to preschool children. Instead of giving children time to play, children attend enrichment classes in the evenings and during weekends to further strengthen their academic performance (Cheng, 2003).

It was identified by the then Prime Minister, in 1997, that a learning nation that promotes lifelong learning in its people, has to begin by recognizing that education is a continuum, starting with the early preschool years and continuing throughout life (“Vision for a total learning environment – Country’s culture, environment will shape what learning means”, 1997). Despite the drive to develop the eagerness to learn and to interact in the early years, the fact remains that preschool education continues to be given the lowest priority on the list of government funding to promote thinking in its curriculum. Furthermore, preschool education is not compulsory nor is there a national curriculum for preschool centres. There is however a call to providers of preschool education to move away from the current predominantly academic emphasis towards a more all round development of the child (Nirmala, 1999).

A kindergarten curriculum framework based on principles of good practices in preschool settings was developed and released by Ministry of Education (MOE) in 2003. This was aimed at ensuring a firm foundation built for the next stage of learning. The principles of this framework also promote a holistic approach to development and learning; fostering integrated learning where children learn that knowledge and skills are linked together in the learning and teaching process; active and interactive learning with adults as supporters in the process of learning (Ministry of Education, 2003).

Despite the Ministry’s initiative, there remains no enforcement for the adoption of the curriculum framework by all preschool centres. Hence, the preschool providers are very much left on their own to interpret what is meant by the goal of inculcating thinking skills and eagerness to learn in young children. So far, however, the investigator is not aware of any curriculum currently available in Singapore that is systematically developed to focus on cognitive skills for young children. This research sets out to ascertain whether or not the Bright Start Cognitive Curriculum that is based on the theories of cognitive development and developed by Haywood,

Brooks and Burns (1992), could be a programme suitable for systematically teaching basic thinking and problem solving skills to young children in Singapore.

1.2 Introduction of the Bright Start Cognitive Curriculum and why it was chosen

There are two well-known theorists, Piaget (1896-1980) and Vygotsky (1896-1934), who have influenced and made important contributions to the field of cognitive education. Their contributions include the teaching and learning of formal processes of logical thinking, with the objective of helping each child to become independent, life-long learners who generate and apply their own cognitive strategies to a wide variety of content (Haywood, 2004). One approach that is based on Piaget's theories of child development is the High Scope curriculum model (Hohmann & Weikert, 1995) which recognises children as active learners, who construct their own knowledge through activities that they plan, carry out and reflect on. The classroom activities revolve around key experiences intended to promote intellectual and social development. A greater depth of discussion of the High Scope model and other early childhood curriculum models and approaches are presented in the literature review in Chapter 2.

The Bright Start Cognitive Curriculum, also draws from the theories of Piaget, Vygotsky, Feuerstein and Haywood. It is a curriculum designed to develop thinking, perceiving and problem solving abilities for children from three to six years of age. The goals of the curriculum include enhancing the development of basic thinking, developing self-motivation, representational thought, enhancing learning effectiveness and preventing special education placement in subsequent years (Haywood, Brooks & Burns, 1992). The content of the curriculum is organised into seven cognitive units and daily lessons within the units that emphasise the development of basic cognitive processes.

Although the basic idea of promoting cognitive development in children and helping them to acquire more effective tools for thinking and learning is not entirely new, its actual implementation has presented many problems. In particular, there has often been a lack of transfer of learning from the cognitive tasks that the children have learned in class to the actual learning in the different content areas (Paour, Cebe & Haywood, 2000). Thus, there have been many instances of failures to find generalisation of cognitive learning beyond the content with which the cognitive learning occurred originally (Paour, Cebe & Haywood, 2000). It may also be possible that the lack of transfer of thinking skills across content areas and into aspects of the children's lives outside school is the result of inadequate pedagogical skills.

The Bright Start Cognitive Curriculum, explicitly spells out some fundamental cognitive processes such as comparison, classification, class inclusion and relations, and teaches these in a systematic way through a series of cognitively focused lessons (Butera & Haywood, 1995). It targets the development of cognitive processes and metacognitive operations that are believed to be prerequisites for academic learning in the primary grades (Butera & Haywood, 1995; Tzuriel, 2001). Children are encouraged to reflect on their own thought processes, evaluate them, and consider whether alternative strategies might be equally effective in problem solving.

One primary distinguishing feature of the Bright Start Cognitive Curriculum is the use of Mediated Learning Experience (MLE) teaching approach as its teaching approach, where the teacher consistently uses process-oriented questions, challenges answers, requiring justification to engage processes of thinking and to enhance metacognitive functions. 'Bridging', a component in MLE used in the delivery of this curriculum, helps children transfer the principles and strategies learnt into a variety of contexts (Haywood, Brooks & Burns, 1992). Each new application helps to define the kinds of situations in which a given principle may or may not be applied, thus refining the principles. Refinement of the principles make them more

secure in the learner's repertoire. Hence, the overall goal in the Bright Start Cognitive Curriculum is to teach children not only to approach particular problems effectively but to be able to tackle new problems as effective, independent learners (Haywood, Brooks & Burns, 1992). This is a common focus in all learning approaches, not just in the Bright Start Cognitive Curriculum, where practice reinforces learning and increases the child's spontaneous use of such applications.

The Bright Start Cognitive Curriculum has been seen by some as a relevant approach to develop cognitive skills in young children. This research study set out to examine and discover the effects of the Bright Start Cognitive Curriculum in terms of promoting thinking skills, communication skills, perceiving and problem solving skills in young Singaporean children.

1.3 The need for the study

In line with the government's initiatives to encourage the development of 'thinking schools and learning nation' through emphasising thinking, communicating and process skills, this study seek to ascertain whether or not the Bright Start Cognitive Curriculum introduced into three Singapore preschools provide evidence and insights into how this cognitive-focused programme can assist in the development of children's thinking and other cognitive skills.

Children from socially disadvantaged backgrounds who lack adequate home support or other resources are often at risk of failure in schools. They usually require additional support in the area of developing thinking skills that underlie the learning of academic content taught in formal schooling in later years. It was noted that previous studies of the Bright Start Cognitive Curriculum show that the programme can help to 'level the playing field' for such children in schools (Cebe & Paour, 2000).

The Bright Start Cognitive Curriculum, based on previous studies, appears to offer the relevant help in the form of the systematic teaching of children's cognitive and

metacognitive skills that are essential for academic achievement and lifelong learning. The investigator of this research study sets out to examine if the Bright Start Cognitive Curriculum, when applied systematically with preschool children, has the potential to lead to increased learning effectiveness, more effective basic cognitive processes and to prepare for subsequent learning as claimed by previous studies (Tzuriel, Kaniel, Zeliger, Friedman & Haywood, 1998; Tzuriel, Kaniel, Kanner & Haywood, 1999).

1.4 The purpose of the study and research questions

This research study aimed to examine the effects of the Bright Start Cognitive Curriculum for Young Children as compared with the regular integrated thematic preschool curriculum. The study examined the differing contributions of these two approaches to gauge whether there would be an increase in children's learning effectiveness and developing cognitive functions that are essential for later school learning. A pre-test post-test experimental design was adopted with a control group that continued to participate in the regular integrated thematic preschool curriculum and an experimental group that was introduced the Bright Start Cognitive Curriculum. This design is further elaborated in Chapter 3, section 3.1. Quantitative data has been complemented by qualitative data gathered throughout the study in order to gain greater understandings and potentially more relevant and useful in answering to the research questions (Cohen, Manion & Morrison, 2000; Kumar, 2005). For example, in this research study, quantitative data were supported by data from children's conversation which have provided insights about children's thought processes.

Research Questions

Set within the Singapore context, the questions asked in this study were as follows :

Research question : To what extent does the Bright Start Cognitive Curriculum yield gains in the cognitive functions of young children in facilitating their

achievement in the academic domain compared with the regular integrated thematic curriculum in Singapore's early childhood education context ?

Sub questions :

- 1) Which cognitive functions, if any, have been enhanced by the Bright Start Cognitive Curriculum?
- 2) What are the programme's effects on the achievement of preschool children in the academic domain?
- 3) What are the effects of the Bright Start teachers' use of mediated learning teaching styles on the development of children's cognitive functions?
- 4) To what extent do the observed teachers interactions with the children fulfill the three essential criteria of mediated learning experience?

1.5 Potential implications of the study

In embracing the vision of 'thinking schools and learning nation' for Singapore, where a nation adopts a national culture that embraces lifelong learning, schools have been encouraged to innovate and nurture a culture of continual life-long learning so that people can think for themselves as well as find solutions to new problems. The Bright Start Cognitive Curriculum may or indeed may not live up to its claims. The question is asked as to whether it in fact fosters the development of cognitive skills. The Bright Start Cognitive Curriculum, if it is shown in this research study to foster the development of cognitive skills in young children, may result in more preschool centres adopting the curriculum or mediated learning experience teaching approach to prepare children for subsequent learning.

The Bright Start Cognitive Curriculum is entirely new to early childhood education in Singapore and its MLE teaching style has so far not been adopted by the preschool teachers here. This study examined if the Bright Start Cognitive Curriculum could help preschool teachers appreciate and adopt a MLE teaching style to help children to transfer or "bridge" the cognitive concepts covered in the Bright Start Cognitive Curriculum lessons into other areas of their learning. The

findings would contribute to a growing body of local research on developing thinking skills and to the field of early childhood development and education.

The investigator sought to find out if the benefits proposed by Haywood (2004) where the Bright Start Cognitive Curriculum build confidence and competence in children as effective thinkers capable of applying their own cognitive strategies to a very wide variety of content, were supported in this particular research study.

1.6 Overview of the method and data collection of this research study

1.6.1 Methodology

The nature of the study involved having to examine objectively the effects of the Bright Start Cognitive Curriculum programme introduced to children from three childcare centres that were using a regular integrated thematic curriculum, and comparing it to the regular integrated thematic curriculum in the control group from two other childcare centres. The study adopted a pre-test, post-test experimental design as well as a qualitative approach to collect data from children and teachers (Kumar, 2005). The sample size comprised of 80 children between five to six year olds, with 43 children forming the experimental group and 37 children forming the control group. A comparison of the scores for the experimental and control groups before and after the respective programme implementation was carried out with the use of the statistical method, two-way ANOVA, a repeated measure to detect main and interaction effects between the variables over time.

1.6.2 Data collection

Children's pre and post tests data was collected from a series of tests as follows :

- Application of Cognitive Function Scale (ACFS) classification subscale (Haywood & Lidz, 2007), please refer to Appendix A
- Raven's Coloured Progressive Matrices (Raven, Raven & Court, 1998) (RCPM),

- Brigance Diagnostic Inventory of Early Development (IED-II) Academic/Cognitive Domain standardised assessment (Brigance 2008), please refer to Appendix B and
- Brigance Diagnostic Inventory of Early Development (IED-II) criterion referenced assessment, known as Brigance 2 (Brigance, 2008) in the study, please refer to Appendix C.

Observations were collected of the teachers' interaction with the children in both the experimental and control groups using the Guidelines for Observing Teaching Interaction (Lidz, 2003). Data from the Children's Response to Mediation Scale (Lidz, 2003) were collected from the experimental group and used as a form of triangulation of the post test data of the children.

1.7 Overview of the rest of the Chapters in this research study

In the literature review in Chapter 2, various theoretical approaches to early childhood education curriculum and cognitive development are presented and previous empirical research evidence conducted in these areas is examined. Discussion is focused on how this particular research study is framed from the relevant literature. In describing the methodology in Chapter 3, both quantitative and qualitative research methods were used to provide greater insights and discovery into the topic. This was explained along with a detailed discussion on the procedures for data collection. In Chapter 4 on data analysis, discussion is focused on how Feuerstein's theory of Structural Cognitive Modifiability has been used for analyzing the data. In Chapter 5, the research questions are revisited and the findings of the study are linked to the literature. In the concluding Chapter 6, a summary of the principal implications of the findings with suggestions as to how this area can be further researched is presented and discussed.

1.8 Summary

This Chapter has provided an overview of the Singaporean background of the study, an introduction of the research study, why it was chosen, the need for the study, the

choice of the research methodology and methods of data collection. The research sets out to investigate the effects of the Bright Start Cognitive Curriculum for young children as compared with a regular integrated thematic preschool curriculum. The study aimed to bring about a greater awareness in the systematic development of cognitive functions in young children, which are prerequisites for learning in the primary grades as well as for lifelong, through the Mediated Learning Experience approach. These aims correspond and support the Singapore's government initiatives in nurturing a spirit of innovation and lifelong learning in the people.

CHAPTER 2

LITERATURE REVIEW

Introduction

The preceding chapter has provided a background of the present study and set out to investigate the effects of the two approaches on children's learning and cognitive functions. Next, it is necessary to set the research study against the background of existing literature. This chapter provides an overview of the theoretical and conceptual framework guiding the research. The chapter begins with a review on the importance of preschool education and relates it to the preschool education scene in Singapore. This is followed by a review of the various centre-based early childhood curriculum approaches; namely the Montessori approach, the Behaviourist approach, and the Constructivist approach, and some other approaches prevalent in Singapore; the rationale for the selection of the Bright Start Cognitive Curriculum for the research study, a review of its theoretical underpinning and a closer examination of the previous studies conducted in the Bright Start Cognitive Curriculum.

2.1 Importance of preschool education

Research in neurobiology, developmental psychology, social sciences and economics has provided understanding of the importance of the early years (Shonkoff, Phillips & National research council, 2000; Barnett, 1995). Children's early experiences impact their learning, behavior and health throughout their lives.

Preschool education plays a very important role in children's development as well as for preparing young children for a better start at primary school. Research studies on the effects of preschool education have pointed to positive and long lasting impact on children's cognitive, social-emotional, language and early number concepts (Sammons, Elliot, Sylva, Melhuish, Siraj-Blatchford & Taggart, 2004). High quality preschool is related to better intellectual and social behavioural development (Sylva & Wiltshire, 1993). The quality of preschool programme has

found to be significantly related to children's scores on standardized tests of reading and mathematics at age 6 (Sammons, Elliot, Sylva, Melhuish, Siraj-Blatchford & Taggart, 2004). Children, especially from a disadvantaged family background, benefit significantly from high quality preschool programmes (Slavin, Karweit & Wasik, 1994). A very well known longitudinal study on the effects of preschool education, the Perry Preschool Project, later known as High Scope, has demonstrated social and economic benefits, including reduced crime and delinquency and improved adult employment and adjustment (Schweinhart, Barnes, Weikart, Barnett & Epstein, 1993).

2.1.1 Preschool programmes in Singapore

In Singapore, parents' expectations of preschool centres to prepare children to succeed in primary schools, have resulted in the need for both quantity and quality of preschool centres (Sharpe, 2002). There is a wide range of preschool programmes in Singapore. There are the academically oriented programmes that focus on the Three Rs (reading, writing and arithmetic) with emphasis on worksheets and homework which appear to be popular among parents. With parents increasingly better educated and are aware of the importance of early childhood education for later development, there is a demand for more play-based and developmentally appropriate programmes (Wong and Lim, 2002).

Preschool programmes in Singapore have been influenced by quality programmes from overseas. Hence, there have been many attempts to emulate the designs of these successful programmes. The influence of philosophers of education, such as Montessori and Dewey, is evident in Singapore's preschool education and many preschool centres are Montessori-based (Kwan, 2000). More recently, the influence of Vygotskian concepts of scaffolding and the zone of proximal development is reflected in the philosophy of many preschools here (Wong and Lim, 2002). Some preschool centres here adopt the Project Approach and adapted some key features from the Reggio Emilia Approach, where children grow in competence to represent their ideas symbolically through various means, such as drawing, painting,

sculpture, building, dramatic play, music, dance etc. Beside these theories, age appropriateness is also another factor for consideration for curricular activities.

Yet another approach that is widely adopted by many preschool centres here is the integrated thematic approach, where the learning activities are planned around a central idea and integrated into all aspects of the curriculum. For example, the central idea could be the theme on 'plants' and a science activity related to the theme can be comparing the stems of plants, a math activity can be counting pumpkin seeds, an art activity can be doing a seed mosaic, a language activity can be a class publication on parts of plants.

The integrated thematic curriculum takes place in a prepared learning environment where learning centres provide activities and play materials that are related to the theme. These facilitate children's development of skills in the areas of language arts, science, math, art and craft, manipulative play, dramatic play, water play etc.

2.2 Overview of approaches in early childhood education

The insights of many educators and theorists have influenced and enriched the teaching and learning of young children. The investigator reviews and critiques the Montessori Approach, High Scope curriculum model, the Behaviourist approach and the Constructivist approach because their philosophies and practices have influenced the preschool programmes in Singapore.

2.2.1 The Montessori Approach

Montessori (1870-1952) saw education as assisting the psychological development of children rather than as imparting knowledge. She felt that teachers often overlooked the importance of unconscious elements in the human psyche, and that understanding children who had difficulty in adapting to society was the key to contributing to their successful development (Wolfe 2002).

Montessori believed that the spirit of a human being is developed through interactions with their environment and she extended the notion of developmental stages to include the idea of a “sensitive period” of a child’s life, where the child is ready for acquiring certain skills and knowledge. “These periods are transitory, and confined to the acquisition of a determined characteristic. Once the characteristic has evolved, the corresponding sensitivities disappears.” (Montessori, 1966, p.38). According to Grazzini (1996), although the sensitivities disappears, the acquired abilities remain for the whole of the individual’s life. When the needs of the sensitive period have been met, the child will have formed an ‘inner conceptual framework’ which will serve him/her in the next developmental phase as he/she moves to more abstract thinking.

Montessori believed that the goal of education was to be in control of oneself, and this would be achieved through independence, self-discipline, concentration and motivation (Wolfe, 2002). The Montessori learning materials, with specific characteristics of self-correction, sensory orientation, concept development and graduated difficulty/ complexity (Henniger, 2005) were developed to meet this goal.

An ordered, welcoming environment was the first principle of Montessori’s Casa de Bambini, or Children’s House, founded in 1907 in Rome. She believed that order in the external environment helps children to organise their often chaotic perceptions of the outside world and build a sense of predictability and security (Roopnarine & Johnson, 2005). Liliard (1972) outlined six essential components of the Montessori learning environment. They are: first, freedom, where the choice of learning experiences will bring about the development of focus and self-discipline in the child; second, structure and order in the learning environment depict and promote the internal order unfolding within the child; third, reality and nature, where the materials are authentic and represent the real world and the child’s inherent interests in the natural world is being catered for in the classroom environment; fourth, beauty and atmosphere that encourages positive and spontaneous response to life; fifth, Montessori’s didactic learning materials that progress from simple to complex

help meet children's development and learning needs; and finally, the development of community life through mixed age grouping.

Montessori believed that children should select their own materials and claim responsibility for clean up as well. As part of the development of this responsibility; Montessori disapproved of rewards and punishments, believing that the child's self dignity could best be developed by intrinsic motivation. She also believed that useless adult assistance to children formed the root of all future repression and that adults too frequently give messages to children that they are incompetent. She noted that teachers should hold back their own agenda and authority so that children could solve their own problems. In summary, the good Montessori teacher operated on three principles: a carefully prepared environment; possession of an attitude of humility and constantly evaluating her/his own motives and the needs of the children; and respect for children's individuality (Roopnarine & Johnson, 2005).

Some of the major criticisms of the Montessori approach from well known educators such as William Kilpatrick (1874-1965) and John Dewey (1859-1952), include the lack of opportunity for free play, and social dramatic play because she saw these types of play activities as frivolous, unfocused and undermined the dignity of the children. Montessori's ideas were ahead of her time, but she failed to keep up with other thinkers in the field of psychology and education (Wolfe, 2002). Not only were the sense and the intellect important but so were feelings, the unconscious, and fantasy, all of which had no part in Montessori's programmes.

a) Previous studies on the Montessori Approach

One of the most important recent works on Montessori by Lillard (2005) showed that except for the devaluation of pretend play for children under six years of age, all of Montessori's major ideas that have been studied have been validated by research on human learning and development.

Another study by Lillard and Else-Quest (2006) compared students from a Montessori public school programme with students who were not in the programme. Comparisons were made between the Montessori group and the control group at two age groups : five year olds and twelve year olds. In this study, there were 59 students in the Montessori group and 53 students in the control group. The five year old Montessori children achieved better on three of the seven scales in the Woodcock-Johnson test battery : letter-word identification, word attack, and applied problems (math). On social/behavioural measure, the Montessori five year olds were more likely to use higher level of reasoning by referring to justice or fairness on a test in which they were given stories and asked how to resolve the problems presented. However, there were fewer significant differences when the Montessori and control children were at the age of 12. Stories written by Montessori children were judged as more creative and used more sophisticated sentence structure. Montessori children were more likely to choose the 'positive assertive response' to social problems. On a questionnaire about feelings toward school, Montessori 12 year olds reported greater sense of community.

b) Implications for practices in early childhood education

Montessori's central vision as well as the key principles, remain viable and relevant today. The practices such as respect for the individual's inherent potential, multi-age groupings, holistic education, individualised and child-centred learning, prepared and learner-responsive environment, the role of the teacher as an observer and guide, and the use of hands-on manipulatives as tools for learning are still being practised widely today (Roopnarine & Johnson, 2005). One of Montessori's greatest contributions to early childhood education and it is widely being used by many preschools today are the hands-on manipulatives with specific characteristics such as careful attention to concept development, graduated difficulty/complexity, self correcting features and the sensory orientation of the learning materials (Henniger, 2005). For example, the cylinder blocks, which are blocks of solid wood containing 10 knobbed cylinders of graduated dimension, each of which corresponds to an equally sized socket; the tower of cubes, which is a series of 10 cubes, graded in

size at exact increments. Each cube is exactly identical except for the single variable of size. This draws the child's attention to that quality, allowing the exploration of the size relationships among the cubes without unnecessary distraction.

In Singapore, the Montessori approach has been widely adapted by preschools. Some kindergartens and childcare centres have adopted the entire approach. Others have adapted and contextualised only aspects of the Montessori approach; in particular, the provision of hands on manipulatives in classrooms and the use of sandpaper letters to develop the mechanics of writing. Montessori had the foresight early in the history of preschool education of seeing education as 'assisting the psychological development of children rather than as imparting knowledge.' It is also interesting that she directed attention to the importance of the 'unconscious elements' in the human psyche. Perhaps if more research attention and effort were directed at this, it may have set the path and the stage for a cognitive curriculum much earlier in history.

Montessori believed that the goal of education was to enable children be in control of oneself, and this would be achieved through independence, self-discipline, concentration and motivation. This finds similarities in Feuerstein's (Feuerstein et.al., 2006) and Haywood's (Haywood, 1992) theory of developing self regulation in children. Another essential component in Montessori's approach is her belief that materials in the classroom are authentic and represent the real world and the child's inherent interests in the natural world is being catered for in the classroom environment. This is similar to Feuerstein's and Haywood's concept of transcendence where the child applies learning in the real world.

Montessori's appreciation of the psychological development of the child gave her the insights and understanding into what Vygotskians would have termed as ZPD- zone of proximal development. She was aware of the need to prepare the child and meet his needs in order to progress into the next development phase.

2.2.2 The Behaviourist Approach

The behaviourist approach to education is based on the learning theories of Edward Thorndike (1874-1949) and B.F. Skinner (1904-1990). These theories explain behaviours in terms of a stimulus and a response and operant conditioning, where consequences are important in controlling the acts that immediately preceded them (Thomas, 1992). Three other components in the behaviourist model of teaching - also known as direct instruction- are reinforcement schedules, shaping of behaviour, and extinction of behaviour (Brewer, 2007).

In the behaviourist view, a child acquires knowledge as a result of repeated interactions with the stimuli in the environment. The consequences of the interactions determine whether the interaction is reinforced and, as a result, will be repeated. The most effective teaching involves the presentation of a carefully selected stimulus and followed by either rewards or punishments associated with the child's response to the stimulus. The behaviourist view is that a child accumulates knowledge through repeated exposure to stimuli and that the learning process is directed by the adult who controls the sequence of stimuli and the reinforcement system (Roopnarine & Johnson 2005 as cited in Brewer, 2007).

As the behaviourists began to accept that feelings and internal state was valid, they looked at how children became socialised. Albert Bandura developed the social learning theory where he examined how children became socialised (Gordon & Browne, 2008). Patterns of reinforcement and reward for socially appropriate behaviours were studied. This is based on the social learning theory developed by Albert Bandura who believed that human behaviour is learned through observations of models. A human model reinforces certain behaviours and hence socialising agents in the environment play an important role in the development of the child. From this arose the concept of modeling where teaching and learning takes place by example (Gordon & Browne, 2008). In the Bright Start cognitive curriculum, the teacher's role in modeling enthusiasm for learning is important in cultivating

children's motivation in learning. Seeing that teachers enjoy their teaching stimulates children's motivation to learn (Butera, 1988).

a) Implications for practices in early childhood education

The behaviourist approach has been practised since 1940s and has continued to be influential in language therapy, preschool education, special education and regular education. One of the implications for early childhood education is the use of extrinsic motivation to motivate children to learn. Another important implication is that behaviours can be encouraged or eliminated through the use of positive reinforcement, punishment and ignoring. According to behaviourists, learning in all subject-matter areas, social interactions, and appropriate classroom behaviours can be controlled through the use of the above three techniques (Henniger, 2005). In a classroom situation, positive reinforcement can be in the form of stickers, verbal praise, a pat on one's back, smiles etc. and punishment can be in the form of time out and verbal reprimand. However, effective positive reinforcements and punishment vary between children and the teacher has to respond carefully to shape their behaviours. The third important implication is the role of modeling. Good modeling can become a powerful technique for encouraging the development of a variety of new behaviours in children in a classroom situation (Roopnarine & Johnson, 2005). The teacher can employ the technique in modeling with a group of children when he/she identifies some children in class who can serve as models of good behaviours to the rest of the class because children will tend to imitate those persons who are more like them.

The limitation of the behaviourist approach is its focus on behaviour shaping and modeling of desirable behaviours and lacking in understanding of what underlies the behaviour or as Montessori puts it "unconscious elements in the human psyche" (Wolfe, 2002). If behaviours were shaped, modeled, directed and controlled by reinforcements, how would young children grow up to adapt to environments where the reinforcements or these shaping forces are no longer the same or present at all in the environments?

2.2.3 Integrated thematic approach

The integrated thematic curriculum reflects Dewey's (1859-1952) philosophy of education where school must represent life; learning becomes meaningful when it is connected to real life situations and children construct knowledge about life in a community of learners such as in a classroom.

Integrated thematic approach involves planning a range of learning activities around a central idea or a topic. These activities integrate the content and processes of many subject areas; such as math, science, language, creative art, motor skills, self and social awareness. Such integration creates a common thread among activities that facilitates children's generalisation of knowledge and skills from one learning experience to another (Eliason & Jenkins, 2003; Machado & Meyer, 2005). Early childhood educators who implement integrated thematic approach incorporate the principles of developmentally appropriate practices into their teaching, the essence of which are age appropriateness, individual appropriateness, sociocultural appropriateness and using the integrated curriculum to facilitate learning (Bredekamp & Copple, 1997).

Through participation in theme activities, children form connections between information that they have gathered. These connections contribute to children's concept development (Kostelnik, Soderman & Whiren, 2007).

In Singapore, many preschool centres have adopted the integrated thematic curriculum. Some of the common themes include my community, transportation, plants, animals etc. The learning activities are planned around the theme to help children to make sense of the world and provide opportunities for children to explore a broad range of content areas; such as art, language arts, science, math etc. integrated into the theme.

2.2.4 Constructivist approach

The constructivist approach is based on the learning theories of Jean Piaget (1896 to 1980) and Lev Vygotsky (1896 to 1934). Examples of constructivist programmes include the High Scope programme, developed by David Weikart; the Reggio Emilia programmes in Italy developed by Loris Malaguzzi, and the Project Approach, developed by John Dewey and expanded by Lilian Katz and Sylvia Chard.

2.2.4.1 High Scope Programme

The High Scope model's development began in 1962 with the High Scope Perry preschool programme, a programme for three and four year old children operated at Perry elementary school in Ypsilanti, Michigan. This programme was designed to help children overcome the negative effects of poverty on schooling, an idea later embodied in Head Start programmes, which has grown steadily over the years through funding from the federal government of the United States (Hohmann & Weikart, 2002). The High Scope programme is based on the theoretical perspective of Piaget, who believed that children learn best when they build understanding through direct experiences with people and objects in the world around them. The High Scope programme, developed by David Weikart, emphasises the development of the whole child and focuses on strengthening cognitive skills through active, hands on learning experience (Henniger, 2005).

A child's development and learning in the High Scope curriculum is organised around a set of key experiences developed from research and development theory.

“The key experiences have been identified in the categories of social and emotional development, movement and physical development, and cognitive development. These key experiences take place in active learning settings in which children have opportunities to make choices and decisions, manipulate materials, interact with peers and adults, experience special

events, reflect on ideas and actions, use language in personally meaningful ways, and receive appropriate adult support” (Hohmann and Weikart, 1995, p.299).

To create a setting in which children learn actively and develop strong conceptual understandings, the High Scope curriculum uses a procedure called the plan-do-review sequence (Hohmann and Weikart, 1995). The teacher encourages children to plan the tasks they want to accomplish during free-choice time, engage in those activities and then spend time later in the day reflecting what they have learned. The plan-do-review sequence is the central device in the curriculum that permits children opportunities to express intentions about their activities while keeping the teacher involved in the whole process.

With the goals of strengthening the overall development of the children, while focusing specifically on cognitive skills, the teachers in a High Scope curriculum take on the following roles: active learners as they work with children; careful observers as they seek to understand the development of the children and plan motivating activities for them; planner of classroom environment to facilitate meaningful and interesting learning for the children and effective communicators as they provide positive interactions to motivate children to reach higher level of understanding (Roopnarine & Johnson, 2005).

a) Previous studies on High Scope

Weikart and his staff first developed and used the High Scope Perry preschool programme to assist disadvantaged children in the Ypsilanti’s public schools in the state of Michigan, U.S.A. By virtue of its experimental design and long term duration, since 1962, the evaluation of the High Scope Perry preschool programme is one of the most thorough examinations of programme effects ever undertaken. The study focused on 123 African American children born in poverty and at high risk of failing in school. In the early 1960s, at ages 3 and 4, these children were randomly divided into a High Scope programme group and a no programme group

which did not receive preschool programme. The two groups have been carefully studied over the years. At age 27, 95% of the original study participants were interviewed with additional data gathered from their school, social services and arrest records (Schweinhart, Barnes, Weikart, Barnett & Epstein, 1993).

The basic outcomes of the study (Schweinhart et al., 1993) are as follows :

- 1) A higher percentage of High Scope students had completed high school than non program students
- 2) Fewer students had been arrested
- 3) More young adults from High Scope programme had a job at age 19 than those not attending the program.
- 4) A greater percentage of these young people were self supporting as young adults
- 5) Nearly three times as many former High Scope students owned their own home
- 6) Fewer students in High Scope have been classified as special education students.

These results, it was argued, (Schweinhart, et al., 1993) translated into considerable savings to the public. Lower costs for special education, jails and police interventions; higher income levels; and less reliance on welfare services all mean that early intervention programmes can be highly cost effective.

b) Implications for practices in early childhood education

The High Scope research has wide ranging implications. These suggest that high quality preschool programmes for children living in poverty can have a positive long term effect on their lives (Schweinhart et al., 1993). Their early educational success leads to later school success, higher employment rates, and fewer social problems such as crime and welfare dependence (Schweinhart et al., 1993). And early childhood education can help individuals realise their potential.

In contrast to the Behaviourist approach, the High Scope approach appears to give attention to developmental domains and in particular with the focus on the children's cognitive skills beyond the manifest behaviours of children. The High

Scope approach reflects the changes in thinking in preschool education but also the changing contexts in preschool education.

Both the High Scope approach and the Bright Start Cognitive curriculum share the similarity of strengthening children's cognitive skills through active and hands on learning in their respective programmes.

2.2.4.2 The Project Approach

A preschool curriculum that promotes the in-depth investigation of the children's immediate environment was first inspired by the ideas of John Dewey (Roopnarine & Johnson, 2005). A contemporary extension and elaboration of these earlier practices, now referred to as the Project Approach, was written by Katz and Chard in their publication, *Engaging Children's Minds* (1989), to rekindle the interests in this important aspect of early childhood education. The Project Approach is an extended in-depth investigation of a topic worthy of children's attention, time, and energy. The investigation undertaken in a project involves the enactment of a variety of intellectual and social dispositions, as well as academic skills. This approach is being widely adopted by preschools in many countries (Katz & Chard, 2000).

According to Katz and Chard (1989), four types of learning goals must be addressed at every level of education; knowledge, skills, disposition and feelings. Knowledge consists of ideas, concepts, facts, and information. Skills are actions inferred from behaviours; such as drawing, counting, gross and fine motor skills. Dispositions are enduring habits of mind or characteristic ways of responding to experience across types of experience, such as curiosity, persistence etc. And finally, feelings are affective states such as feelings of belonging, confidence, self-esteem etc.

The inclusion of project work in early childhood curriculum helps to ensure that the construction and acquisition of worthwhile knowledge and mastery of basic skills can occur in such a way that the dispositions to use them are also strengthened

(Katz, 1994). Furthermore, children's involvement in project work is typically accompanied by feelings of self confidence, engagement, enthusiasm and pleasure. The incorporation of the project work in the curriculum helps to ensure all four categories of learning goals are addressed concurrently (Katz, 1994).

In the project approach, the teacher selects a topic on the basis of the children's interests, curricular goals, and the availability of local resources. The teacher brainstorms his or her experience, knowledge, and ideas, representing them in a topic web. The potential scope of the project is assessed. A web of ideas is developed throughout the project and continues to be useful for planning and recording its progress (Kostelnik, Soderman & Whiren, 2007).

The projects generally develop through an introductory phase, a research phase, and a review phase. This three-phase structure helps the teacher organise and guide the study in ways that match the children's interests and personal involvement. Most of the investigation is hands-on and makes active inquiries into various aspects of the topic. At the conclusion of the project, the teacher helps children develop a culminating experience, in which they can share what they have learned with others (Katz & Chard, 1989; Kostelnik, Soderman & Whiren, 2007; Brewer, 2007).

Assessment is carried out daily as the children plan their work and implement their plans. The teacher notes how well the children understand the information they are learning, how well they can apply the skills they have acquired and how well they can account for what they have learned, explaining it to other children at class meetings and in the final sharing or celebration of learning (Kostelnik, Soderman & Whiren, 2007). The teacher makes anecdotal notes about dispositional learning and how children approach their work, collaborate with peers and develop their strengths and interests (Kostelnik, Soderman & Whiren, 2007).

a) Implications for practices in early childhood education

Learning in all four types of goals-knowledge, skills, dispositions and feelings - is facilitated in different ways. Children construct knowledge through active and interactive processes. The knowledge has to be related to meaningful contexts and relate to children's interest, and at the same time helps to extend, deepen and improve understandings of their immediate environment. Skills can be acquired and strengthened through a variety of processes; such as observation, recording etc. as well as through purposeful application in meaningful contexts (Brown, Collins and Duguid, 1989). Dispositions cannot be taught directly, they are to be strengthened through ample opportunities for their enactment. The findings suggest that curriculum that emphasises child-initiated meaningful learning tasks is more likely to strengthen such dispositions as to seek mastery, to persist at challenging tasks (Katz & Chard, 1989). Like dispositions, feelings cannot be taught directly; they are experienced and strengthened or weakened in the context of interactions and activities that give rise to them. The inclusion of project work increases the variety of types of tasks and levels of difficulty available, such that all members of the class are likely to find meaningful work that can enhance the feelings of competence, and of belonging (Katz & Chard, 1989).

In summary, the incorporation of the project approach into the curriculum of early childhood education addresses all four categories of learning goals and makes possible the application of the principles and practice derived from current knowledge of children's development and learning.

The Project Approach and the Bright Start cognitive curriculum share the goals of developing children's intellectual dispositions such as to solve problems, to strive for accuracy, speculate about cause and effect relationships and to find out about things.

2.2.4.3 Reggio Emilia Approach

The founding leader of Reggio Emilia approach, Loris Malaguzzi (1920-1994), was a social constructivist influenced by Dewey, Piaget and Vygotsky. He drew a

powerful image of the child who is curious, intelligent and competent. Malaguzzi's vision "education based on relationships" focuses on children in relation to people, things and ideas. The goal is to support children in exploring and investigating the relationships around them. The Reggio Emilia approach preschools in Italy are based on the following principles (Brewer, 2007; Roopnarine & Johnson, 2005; Edwards, Gandini & Foreman, 1993; Hewett, 2001):

- Schools are systems of relations, such that the well being of children is dependent on the well-being of teachers and families.
- The community is an integral force in school, providing both monetary support and involvement with programmes and children.
- Children have numerous creative, intellectual and communicative potentials, each of which deserves to be respected and nurtured.
- Teachers consider themselves as learners as they work with children, other teachers and parents.
- Educational spaces must serve the needs of all who utilize them, such that early childhood centres are conceptualized as centres of exchange and relationship building among and between children, teachers and families.
- The curriculum is emergent, as children select projects, continue with them by choice, and return to them as they gain new insights.
- Documenting children's work is crucial to the success of the programmes.

Each school has teachers, a *pedagogista* and an *atelierista*. The *pedagogista* works with teachers to consider what experiences mean to children, how to help children learn more, and what additional experiences should be planned. The *atelierista* is the art director, who helps teachers and children express their interests and knowledge in many different media (Edwards, Gandini & Foreman, 1993).

One of the key elements of the Reggio Emilia schools is the documentation of children's learning.

“Careful consideration and attention are given to the presentation of the thinking of the children and the adults who work with them. Teachers’ commentary on the purposes of the study and the children’s learning process, transcriptions of the children’s verbal language (words and dialogue), photographs of their activity, and representations of their thinking in many media are composed in carefully designed panels or books to present the process of learning in the schools” (Cadwell, 1997, p.6).

This documentation, which is shared with parents and the community, creates a history of the child’s learning and is used by teachers to explore possibilities of future experiences (Kroeger and Cardy, 2006).

Another key element of the Reggio Emilia schools is the ongoing nature of the projects. In Reggio Emilia school, projects often last for months and the children continue to add to and revisit them again and again (Edwards, Gandini & Foreman, 1993; Brewer, 2007).

a) Implications for practices in early childhood education

Reggio Emilia plays a central role in expanding our understanding of the contemporary theories of children’s learning & development (New, 1998). Reggio Emilia’s principles about how children learn are drawn from Vygotsky’s socio-cultural theory and through project work, one can witness the compelling illustrations of the interplay between social and intellectual processes (New, 1998). Seeing and reading how teachers in Reggio Emilia attend to children’s questions, help early childhood educators to rethink the implications for interaction between the teacher and child at the zone of proximal development (New, 1998).

Another major influence of Reggio Emilia’s approach on early childhood educators is the growing use of documentation, not only as a means of observing and assessing young children, but also as a vehicle for teacher development (Oken-Wright, 2001). Documentation provides a platform for teachers to reflect, share and

gain insights that can guide them in their ongoing curriculum decisions (Oken-Wright, 2001). Educators are increasingly utilizing documentation strategies as means for systematically following and studying the ways the individuals as well as groups of children develop ideas, theories and understandings (Turner & Krechevsky, 2003)

In Singapore, the constructivist approach which include the Project Approach has been widely adopted by preschools. Most preschools combine project work with thematic approach or academic learning or learning centre approach. Project work complements and enhances what children learn through other parts of the curriculum (Katz and Chard, 1989). Projects tend to be emergent and negotiated rather than totally preplanned by the teacher; therefore, they provide the less structured, more informal part of the curriculum in the preschool years (Katz and Chard, 1989). At the same time, children's acquisition of knowledge and skills by formal instruction are likely to be strengthened when the knowledge and skills are applied in project work. Hence, project work complements the curriculum in its goal of facilitating children's learning.

There are no preschools in Singapore that have fully adopted the High Scope curriculum model with the central features of the plan-do-review cycle and the key learning experiences as mentioned in section 2.2.4.1. However, the feature of active learning in the High Scope curriculum has been adopted and incorporated by many preschools here where learning centres have been set up for children to learn actively and construct their own knowledge.

Practitioners of the Reggio Emilia approach in Italy have long asserted that the approach cannot be replicated in totality outside Reggio Emilia because the features of the curriculum have their roots that extend deep in the city's political history. In order to make the approach work and preserve its integrity, one must have all the elements that constitute the Reggio Emilia approach, which have taken many years to develop and are still undergoing continuous refinement (Katz, 1997). Early

childhood educators in Singapore, like their counterparts in other parts of the world, have been inspired by the Reggio Emilia approach and some have adapted some elements of the approach in their local setting which include involving young children in extended investigations through project work and representing their learning symbolically through visual arts, music, drama and writing.

The Reggio Emilia approach draws attention to a key ingredient in early childhood care and education, and that is relationships. The early childhood centre as a centre of exchange and relationship building directs attention back to the child as a dynamic, developing human being and not just as a vessel for the impartation of knowledge. Crucial to this therefore, would be the need to understand the path of learning and progress of the child through documenting the ways children develop, think and understand. Similar to the Reggio Emilia's emphasis on relationships in the preschool setting, the Bright Start Cognitive curriculum provides a high quality interaction between the child and his/her social environment through the MLE teaching approach which is elaborated in detailed in section 2.4.7.

2.2.4.4 Comparison of the Constructivist programmes

Brewer (2007) suggests that among the three curriculum models, High Scope, Project Approach and Reggio Emilia, all of which are based on the Constructivist approach, the points of agreement are summarised as follows:

- 1) All contend that a basic objective to be drawn from Piaget's work is to foster structural change in children's reasoning in the direction of operational thought.
- 2) All emphasise the fundamental importance of the child's action for learning and development.
- 3) All borrow ideas from the child development tradition in early education for materials, equipment, and activities that permit children to be active.

4) Each recognises certain limitations in using Piaget's theory alone as a basis for educational practice.

Programmes differ in their definitions of action, the extent of emphasis on logic in language, the extent of reliance on child development traditions and how cooperation and interests are fostered (Brewer, 2007). Some programmes place more emphasis on children's ability to articulate their understanding; others emphasise performance. Some programmes allow more time for free play and free expression than others. Some programmes rely on free play activities to help children develop cooperative behaviours; others specifically plan for interventions in behaviour cycles (Brewer, 2007).

Constructivists believe that children want to learn and are, in fact, always learning. They also believe that children construct their own understandings and are continually refining them in terms of new experiences and knowledge (Brewer, 2007). Instruction in a constructivist programme is provided primarily to individual children and to small groups where the child's needs are being catered for more adequately; whole-group instruction occurs less often. More frequently, the teacher has arranged an experience in which to engage the learners and then asks them questions as they participate in the tasks. In a constructivist programme, curricula are planned and learning experiences are selected to follow children's interests or expose them to new areas in which their interests might be aroused (Katz & Chard, 1989). The process of finding information, analyzing data, and reaching conclusions is considered more important than learning facts (Katz & Chard, 1989). In fact, children will learn many facts and concepts when these are embedded in meaningful contexts. Constructivists believe that it is important to select curriculum experiences containing content that can be acted on in various ways. The teacher must also consider the developmental stage of the learner and the complexity of the tasks required to ensure that learning takes places successfully for the learner (Brewer, 2007).

The goal of any constructivist programme is to stimulate children in all areas of development. Programmes attempt to keep a balance so that all areas of development are addressed and none are neglected. They are all concerned with the development of children's thinking and reasoning abilities and their abilities to represent experiences in meaningful ways. Encouraging children to become actively involved in their own learning and developing children's desire to continue to learn are also important goals.

2.2.5 Comparison of the various approaches

All the programmes highlighted have one common goal of facilitating children's learning. But they all differ on the means to achieve this goal, see Table 2.1.

Educators who adhere to the Montessori philosophy believe that children learn best through interaction with self-correcting and sequential materials in a prepared environment. There is little emphasis on interaction between child to child and the teacher's role is primarily that of an observer. She/he demonstrates the proper use of materials and leaves the child to use the materials without interference (Wolfe, 2002). The teacher trusts in the eventual appearance of a focused and calm child who will reveal himself or herself through the purposeful activities involving the materials and referred to as "work" (Montessori, 1963 as cited in Roopnarine & Johnson, 2005). Educators who subscribe to the behaviourist philosophy, believe that children sometimes learn best in a highly structured environment in which information presented is carefully sequenced and rewards are controlled. Those who hold the constructivist view of learning believe that children construct their own knowledge through interactions with objects and people. They are concerned with the development of children's thinking and reasoning abilities and their abilities to represent experiences in meaningful ways.

2.2.6 Investigator's reflections

From the investigator's review of the various curriculum approaches thus far, a component that does not appear to be evident in all the curricular approaches is the

transfer of learning to other areas of development and other situations or settings in a child's life.

The three models of constructivist approach claim to emphasise the importance of promoting thinking, as well as knowledge about the world, as essential foundations for successful learning. However, it appears that each of them lacks a systematic and explicit approach to developing children's cognitive skills and metacognitive processes and there appears to be a lack of transfer from the cognitive tasks that the children have learned in class to the actual learning of the different content areas (Paour, Cebe & Haywood, 2000).

Similarly, in the Montessori programme where the conceptual learning is very much limited to the self correcting, graduated didactic materials, there is little evidence to suggest that such conceptual learning has been transferred to the learning of different content areas. This is also evident in a behaviourist approach where academic competencies and subject area content is emphasised and the cognitive learning derived from the content areas does not appear to generalise to other areas of development and other situations or settings in a child's life.

Table 2.1 Comparison of the Different Approaches

	Behaviourist Approach	Montessori Approach	Integrated Thematic Curriculum	Constructivist Approach	Bright Start Cognitive Curriculum
Theorists	-Edward Thorndike and B.F. Skinner	-Maria Montessori	-Dewey	-Jean Piaget -Lev. Vygotsky	-R. Feuerstein -Jean Piaget -Lev. Vygotsky -Carl Haywood
Goals	-academic achievement -development of social skills	-self control development of individual responsibility -training of the senses	-conceptual development -integrate content and process in the learning	-development of the whole child with specific focus on cognitive skills (High Scope)	-to enhance and accelerate the development of basic cognitive functions -to identify and

			activities planned around the theme	-development of the four goals- knowledge, skills, disposition and feelings (Project Approach) -development of relationships, learning to collaborate and appreciate diversity in ideas and expressions (Reggio Emilia).	remediate deficient cognitive functions -to develop task-intrinsic motivation -to develop representational thought -to enhance learning effectiveness and readiness for school learning - to prevent unnecessary or inappropriate special education placement.
How Children Learn	-through positive reinforcement and punishment -through modeling	-through his/her senses -through experience	-through active learning	-through active learning -through investigation -through participation in project work -through symbolic representation	-through task intrinsic motivation -through mediation -through active learning
Role of teacher	-direct teaching -role modeling	-observer and guide	-facilitator of children's learning -direct	-facilitator -collaborator with children and families	-uses mediated learning experience to facilitate

			teaching	- document children's learning to guide curriculum decisions (Reggio Emilia)	children's cognitive development - 'bridge' the cognitive functions and strategies to familiar contexts and different content learning
Others	-highly structured environment with carefully sequenced information	-well prepared environment with self correcting and sensory orientation manipulatives	-well prepared environment with learning materials that are related to the theme	- use of environment to promote learning and relationship	-involve parents to extend children's learning of cognitive functions in home setting.

2.3 Selection of the Bright Start cognitive curriculum for this research study

In embracing the vision of thinking schools and learning nation for Singapore, there is a need to inculcate an eagerness to learn even from the early years through the systematic development of children's cognitive and metacognitive skills. Previous studies on the Bright Start cognitive curriculum have suggested that the programme have succeeded in "leveling the playing field" by equipping high risks children and children from low SES, with the cognitive and metacognitive skills to learn in schools (Haywood, Brooks and Burns, 1986; Paour, Cebe, Lagarrigue and Luiu, 1993; Tzuriel, Kaniel, Kanner and Haywood, 1999; Paour, Cebe and Haywood, 2000). In Singapore, there are children who are at risks of failure in school with many of them coming from disadvantaged and non-English speaking homes. They may benefit from Bright Start cognitive curriculum and its emphasis on the

systematic development of cognitive and metacognitive skills to help them to learn in school. Hence, the Bright Start cognitive curriculum for young children, based on the theories of cognitive development, appear to offer an important contribution in these aspects.

Ashman & Conway (1997) highlighted six types of thinking typically related to thinking skills programme:

- Metacognition
- Critical thinking
- Creative thinking
- Cognitive processes such as problem solving and decision making
- Core thinking skills (such as representation and summarising)
- Understanding the role of content knowledge

The above thinking skills vary according to the age group and the context in which they are being taught. The Bright Start Cognitive Curriculum involves the development of the basic cognitive skills and metacognition processes in young children. Through the process of ‘bridging’, the children are helped to apply these skills in a variety of contexts, including the context where new content knowledge is learnt.

The Bright Start Cognitive Curriculum for young children, based on a comprehensive theoretical approach synthesized by its authors from several developmental theories, such as Feuerstein, Piaget, Vygotsky and Haywood’s transactional view of nature and development of human ability (Haywood, Tzuriel & Vaught, 1992), fulfill Walsh’s and Gardner’s (2005) high quality thinking environment particularly in the adult’s role and the children’s actions.

The Bright Start cognitive curriculum is organised according to several cognitive units with each unit designed to address a fundamental aspect of cognitive functioning of preschool children. Classification, sequence and pattern skills are

among these units. Not only does the Bright Start cognitive curriculum develop children's cognitive processes, it also develops children's metacognition through the use of a mediational teaching style. Children are taught to be aware of their thinking processes because this is a prerequisite to the application of reasoning processes. Once children know about their own learning and thinking, teachers can talk to them about these processes. They share a common vocabulary and referents concerning these activities. According to Brooks (1989), by labeling the various cognitive functions, children are better equipped to manipulate them when necessary to solve a problem. Children can then be reminded to look systematically, make a plan or make a picture in their heads. Finally, in mediated learning experience, the adult scaffolds the children's learning, models thinking strategies, uses an array of open-ended questions and makes reference to previous learning.

One assessment tool, the Quality Learning Instrument (QLI) developed by Walsh & Gardner (2005), that evaluates early years learning environment identifies factors crucial in promoting the development of high quality thinking environments and they are the adult's role, the children's actions and the physical environment. One dimension of QLI specifies the indicators of high quality thinking experience in terms of the children's ability to categorize and sequence successfully, explain why they have done things in a certain way, make an attempt in solving problems themselves, reflect on previous work, engage in planning and complete the task competently. Indicators of high quality thinking experience in terms of adult's role include scaffolding the children's learning, modeling thinking strategies, using an array of open-ended questions and making reference to previous learning. The Bright Start Cognitive Curriculum appears to be characterised by several of these indicators of high quality thinking both in terms of child's actions and adult's role.

Another reason for my choice to conduct a study on the Bright Start Cognitive Curriculum is that this programme focuses on the systematic development of basic cognitive functions that are prerequisite for learning not just in the primary grades but also for lifelong learning. The Bright Start Cognitive Curriculum encourages

children to reflect on their own thought processes, evaluate them, and consider whether alternative strategies can be equally effective.

The Bright Start Cognitive Curriculum takes the Mediated Learning Experience (MLE) approach to facilitate adequate cognitive functioning and task intrinsic motivation to learn in young children (Feuerstein, Rand, Hoffman & Millier, 1980). It recognises the important role of the ‘mediator’-the teacher- to help children understand the generalised meaning of their experiences, of new learning and of relationships. The presence of the mediator between the child and the environment is essential for the child’s adequate cognitive development. Inadequate cognitive development and hence ineffective learning and problem solving is a result of a lack in mediated learning experience rather than the deficiency in the child. The single most important distinguishing characteristic of the teacher’s behaviour in the Bright Start Cognitive Curriculum for young children is the use of MLE teaching style. The goal of mediated learning experience teaching approach is to extract from every encounter the children have with content materials the maximum learning of generalizable principles and strategies of perceiving the world, of thinking systematically, of learning, and of problem solving (Brooks & Haywood, 2003).

The Bright Start programme, when systematically implemented with young children, will probably lead to increase in learning effectiveness, more effective basic cognitive processes and thinking skills, and to prepare children for school learning. The investigator will review previous studies on the Bright Start cognitive curriculum that has provided evidence in support of the above claims in section 2.5.1. The question is : Will the Bright Start Cognitive Curriculum be able to lead to increased learning effectiveness and the development of more effective basic cognitive processes for the children in Singapore that previous research studies have claimed ?

Finally, the goals of the Bright Start cognitive curriculum may be particularly relevant to the Ministry of Education’s vision of nurturing young Singaporeans

with minds that keep inquiring, instill in them the passion for learning, develop the habit of life-long learning and foster the spirit of innovation.

2.4 Theoretical Background of the Bright Start Cognitive Curriculum for Young Children

The Bright Start Cognitive Curriculum for Young Children is based on Piaget's theory of the cognitive development of children, Vygotsky's social context of cognitive acquisition within the "zone of proximal development", Feuerstein's theories of structural cognitive modifiability and of mediated learning experience, as well as Haywood's "transactional" view of the nature and development of intelligence (Haywood, Brooks and Burns, 1992).

2.4.1 Piaget's concepts on cognitive development of children

At the core of Piaget's theory is the idea that cognition is one form of adaptation between organism and environment that is seen throughout the living world. The child is actively trying to make sense of the world, just as any organism must try to adapt to its environment. According to Piaget, 'adaptation' refers to the organism's tendency to adjust its structures to the environmental demands. 'Adaptation' is preceded by 'assimilation', which involves the incorporation of new information into existing schemes. Assimilation is not the mere registration of information but the active construction of external data to fit with the child's existing schema (Bjorklund, 1989). Complementary to assimilation is the process of adaptation, which is the changing of a current schema in order to incorporate new information. Accommodation occurs when children are confronted with information that cannot be interpreted according to current schemes, resulting in a modification of the existing scheme to incorporate new experience (Bjorklund, 1989). Piaget recognised that cognitive development is influenced by several other factors which include brain and physical maturation; interaction with the physical world; reflection on the logical rules that could derive from or applied to it; social interaction and equilibration, a concept which is unique to Piaget's theory. Because these factors were so different, and development was so smooth and universal, Piaget saw

equilibration, an unending internal balancing of accommodation and assimilation, as the integrating force behind development; together, assimilation, accommodation and equilibration are the key entities of cognitive development (Wadsworth, 1989). In summary, at the heart of Piaget's theory is the idea that intelligence is a matter of active discovery of reality. He believed that children's active construction of their own understanding is fundamental to their cognitive growth.

The main form of social interaction that Piaget discussed as contributing positively to cognitive development was children's conflict with peers whose reasoning led to a different conclusion. The recognition of disagreement was seen as provoking further thought in order to reduce conflict and remove the contradiction. When children see that when someone whom they regard as very much like themselves, disagrees with them, to children, this can amount to a recognition that they might potentially be making a wrong judgment (Meadows, 2006). Disagreement with someone who is felt to be unlike oneself would not spark off an internal conflict, thus, disagreement with an adult, especially correction of one's ideas by an adult, would have little benefit for cognitive development because adults are viewed as different from children (Meadows, 2006). The child may submit to the adult's authority to the extent of parroting the correction, but will not internalize it because it would not be recognised as potentially one's own problems (Meadows, 2006). Piagetian emphasis is certainly on conflict rather than agreement or instruction as the route to an improvement in one's own understanding. Piaget draws out from his theory the value that peer interaction can potentially contribute to the cognitive development of children.

Piaget was deeply opposed to the idea of transmission of knowledge from adult to child as a model for cognitive development. Interaction with adults was seen as irrelevant or worst, detrimental as it interferes children's exploration of their physical environment and hence their active construction of knowledge (Mercer & Littleton 2007). He suggested that adults should restrict themselves to providing rich, stimulating and generally supportive environments for children.

The Piagetian model is based on one key idea: there are psychological structures in people's minds that explain their behaviours, that are universal across cultures, settings and tasks, and these structures are essentially independent of the individual's relations to other individuals, to social practices, and to the cultural environment (Ginsburg & Oppenheimer, 1988).

According to Piaget, thought processes develop sequentially and he divided cognitive development into four major periods: sensorimotor, preoperations, concrete operations and formal operations. The three to six year old children, for whom the Bright Start Cognitive Curriculum was developed, are normally approaching the concrete operational thinking stage. According to Haywood et al. (1992), the major development of cognition within this stage are classification, and class inclusion, relations (including seriation, space, time, causality), conservation and number concepts. The highest accomplishment of the period is activity that depends upon representational or symbolic thought. In order to develop the fundamental cognitive functioning of the children approaching concrete operational thinking, the Bright Start Cognitive Curriculum is divided into units which focused on number concepts, conservation, comparison, classification, sequence and pattern.

2.4.2 Vygotsky's social context of cognitive acquisition within the "zone of proximal development"

Like Piaget, Vygotsky was interested in the development of cognitive processes that he termed the 'higher mental functions' (Bodrova & Leong, 2007). But Vygotsky's theory of cognitive acquisition challenges Piaget's theory of cognitive development. Far from being internal and individualistic, Vygotsky asserted that cognitive abilities and capabilities are formed and built up in part by social phenomena, they are intersubjective and created through interaction with the social environment. Description of cognition without making reference to the importance of social interaction that constitutes it, is seriously incomplete and provide a distorted and misleading picture.

Vygotsky (Vygotsky, 1929 as cited in Haywood, 2004) believed that the essential cognitive processes consist of symbols, signs, scientific concepts and similar abstractions, which are necessary for adequate cognitive development of children and which are already contained in their culture. Hence, cognitive development requires the successful transmission of culture from one generation to the next. It is when cultural transmission fails or is done inadequately that problems arise in the child's development. Adequate cognitive development requires the active participation of adults interacting with children in order to transmit the essential elements of their culture or to help the children to acquire their own logic systems (Haywood, 2004).

2.4.3 Zone of Proximal Development (ZPD)

Vygotsky proposed that each child has “an actual developmental level” which can be assessed by testing the child individually, and an immediate potential for development and he termed this difference between the two levels the zone of proximal development (Tudge, 1990).

“The zone of proximal development ...is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under the adult guidance or in collaboration with more capable peers (Vygotsky 1978 as cited in Meadows, 2006, p.308).

Between maximally assisted performance and independent performance lies the varying degree of partially assisted performance. The skills and behaviours in the ZPD are dynamic and constantly changing because this is where learning and cognitive development occur (Berk & Winsler, 1995). Tasks that the children cannot do independently but they can do with assistance from others invoke mental functions that are in the process of being developed (Berk & Winsler, 1995).

Vygotsky maintained that the level of independent performance is an important indicator of development but argued that it is not sufficient to completely describe development. The entire ZPD should be used to determine the child's developmental level because it reveals skills on the edge of emergence and the limits of the child's development at this specific time (Bodrova & Leong, 2007). With this full assessment, it will then be possible to set targets for optimum instruction. Teaching is good only when it 'awakens and rouses to life those functions which are in a stage of maturing, which lie in the zone of proximal development' (Wertsch and Stone, 1985 as cited in Meadows, 2006. p. 309). Tharp and Gallimore (1988) described the role of the adult in "rousing to life" the cognitive processes that are emerging in rudimentary form. Hence, Vygotsky placed the emphasis on the interaction between teacher and pupil, or the more expert person and a relative novice one. This interaction may involve giving hints and clues, rephrasing questions, asking the child to restate what has been said, asking the child what she/he understands, demonstrating the task or a portion of it. The interaction could also take the form of indirect help, such as setting up the environment to facilitate practicing a specific set of skills (Bodrova & Leong, 2007).

Wood, Bruner and Ross (1976) proposed that the expert provides scaffolding within the ZPD to enable the novice to perform at a higher level. With scaffolding, the task itself is not changed, but what the learner does initially is made easier with assistance. Gradually the level of assistance decreases as the learner takes more responsibility for performance of the task (Wood, Bruner & Ross, 1976). Scaffolding helps a learner accomplish a task that he or she would not have been able to do independently. It is this special, sensitive kind of help that is intended to bring the learner closer to a state of competence that will enable him/her to complete the task on his/her own (Mercer & Littleton, 2007). For Vygotsky, individual self-supported competence is only possible if successful performance has been established through assisted learning (Mercer & Littleton, 2007). A gradual transition from other regulation to self regulation as the child moves towards the upper part of the ZPD and becomes able to do independently what previously could

only be done with assistance. This zone of proximal development describes the children's ability to internalize problem solving strategies available overtly in the social environment (Rogoff & Gardner, 1999).

'The teacher serves the learner as a vicarious form of consciousness until such a time as the learner is able to master his own action through his own consciousness and control. When the child achieves that conscious control over a new function or conceptual system, it is then that he is able to use it as a tool. Up to that point, the tutor in effect performs the critical function of 'scaffolding' the learning task to make it possible for the child, in Vygotsky's word, "to internalize external knowledge and convert it into a tool for conscious control." (Bruner 1985 as cited in Meadows, 2006, p.309).

For Vygotsky's internalization to be effective, the Bright Start Cognitive Curriculum programme creates social environment that is appropriate for the acquisition of cognitive tools, which includes instruction in problem solving and at the same time, provide a high quality of interaction between the child and the social environment (Haywood, Brooks and Burns, 1992). The adult establishes references to what the child already knew to allow him/her to build new information and skills into existing knowledge structure (Rogoff & Gardner, 1999), encouraging the child's progress in his/her ZPD. This is achieved through the daily lessons which build on the learning from the previous lessons. The child learns the information and skills while participating at slightly challenging level. Subsequently, the child 'bridges' his/her learning of the cognitive functions by applying them to other situations such as at home, in public places etc. In the Bright Start Cognitive Curriculum, where MLE teaching style is used, the primary role of the teacher is a mediator, i.e. a guide of students' successive encounters with the environment. MLE teachers try to use learning experiences to have the students learn more than the content; they help them to generalize concepts, rules, explanations and strategies

that can be used later with different content. Meditational teachers have cognitive growth as a primary goal and they aim to develop students as independent thinkers (Haywood, 1990). Hence, meditational teaching style also aims to promote self regulated, effective and independent learners.

2.4.4 Vygotsky's Theory of Mediated Activity

Vygotsky postulated that higher mental processes as functions of mediated activity (Vygotsky, 1978, 1986 as cited in Kozulin & Presseisen, 1995). Three major classes of mediators were suggested: material tools, psychological tools and other human beings (Kozulin, 1990 as cited in Kozulin & Presseisen, 1995). Material tools have only indirect influence on human psychological processes, because they are directed at the processes in nature. Nonetheless, the use of material tools puts new demands on human mental processes. According to Vygotsky (Kozulin & Presseisen, 1995), material tools depend on collective use, interpersonal communication and symbolic representation. This symbolic aspect of tool-mediated activity gives rise to psychological tools, which mediate humans' own psychological processes. "Among the most ancient psychological tools Vygotsky mentioned are such "psychological fossils" as " casting lots, tying knots and counting fingers" (Vygotsky, 1978 as cited in Kozulin, 1990, p. 151). Beyond these primitive tools lies a vast area of higher order symbolic mediators which include natural and artificial languages, as well as discourses and cultural-symbolic systems of different nations (Kozulin & Presseisen, 1995).

Development occurs in the context of individuals' interaction with social agents; hence language is an important mediator of developmental change. Vygotsky believed that language plays a central role in cognition (Bodrova & Leong, 2007). Language facilitates the shared experiences necessary for building cognitive processes. Language is an actual mechanism for thinking and it is the processes through which the external experience is converted to internal understanding (Bodrova & Leong, 2007).

Vygotsky suggested two possible approaches in mediation through another individual. The first approach was expressed in Vygotsky's statement that "every function in the child's cultural development appears twice: first, on the social level, and later on the individual level; first between people (inter-psychological) and then inside the child (intra-psychological)" (Vygotsky, 1978 as cited in Kozulin & Presseisen, 1995. p. 69). The second approach focuses on the role of the other individual as a mediator of meaning. In Vygotsky's theory, mediation through another individual was closely linked to the notion of symbolic function. The human mediator is a carrier of signs, symbols and meanings however, Vygotsky did not attempt to elaborate on the activities of the human mediators beyond their function as vehicles of symbolic tools (Kozulin & Presseisen, 1995). This left a gap in Vygotsky's theory of mediation which was filled by the work of Feuerstein and the whole idea of mediated learning has been further developed.

2.4.5 Reuven Feuerstein's Theory of Structural Cognitive Modifiability (SCM)

Reuven Feuerstein has elaborated on the necessary characteristics of a social environment that enhances cognitive development. His theory is focused upon enhancing parents' and teachers' effectiveness in facilitating cognitive development in the child's zone of proximal development (Haywood, Brooks and Burns, 1992).

Feuerstein differs from Vygotsky in his emphasis on the critical importance of the human being as the mediator, acting in an intentional and volitional manner, and did not view Vygotsky's material tools and psychological tools as having the same mediational potential. Second, Feuerstein considers Mediated Learning Experience as producing structures and potentials that substantially change the concept of the ZPD. He has replaced the notion of "potential" by that of "propensity" to convey the open, unrestricted change that is possible with the application of Structural Cognitive Modifiability (SCM) (Feuerstein, Feuerstein, Falik, Rand, 2006). The ZPD thus has inherent conceptual limitations, and many of those using this concept in the context of cognitive modifiability may be accepting limitations, particularly

the upper “boundaries” of the zone, which are contrary to the conceptualisation of SCM (Feuerstein et al., 2006).

According to Feuerstein (Feuerstein et al., 2006), cognitive modifiability refers to structural change and once set in motion, this will determine the future course of an individual’s development. Structural change refers to the changes in the mental behaviour of an organism. Except in the most severe instances of organic and genetic impairment, the human organism is seen as being open to modifiability at all ages and stages of development. The brain shows plasticity and flexibility, new pathways, new synapses and new or differently activated neurochemical conducive agents can be formed. This revolution in brain science has major implications for therapy, education, rehabilitation and by extension the concept of human being as modifiable entity.

There are three theoretical pillars to SCM (Feuerstein et al., 2006, p. 25):

- “Human being is the outcome of a triple ontogeny. This triple ontogeny can be seen and understood as an important basis for the structure of human modifiability.
- Modal behaviours represent the states rather than traits of the organism, and lead to a new and more adaptive definition of intelligence.
- Brain plasticity results in the generation of new structures, created through external and internal behaviour.”

Feuerstein (Feuerstein et al., 2006) refers to the development of an individual as a result of three contributing factors; namely, biology, socio-cultural elements and mediated learning experience. Developmentally, there is a triangulation between these three determinants. First, biology provides us with the vital apparatus for functioning, allowing a certain level of interaction with the world. Biology determines the life conditions, the level of development, and will have decisive effects on the individual’s quality of life. But a human being is not ultimately determined by his or her biology. The socio-cultural element of experience is the

second contributing factor in the development of an individual. This is consistent with the Vygotskian schema but ultimately Feuerstein diverges from it in the development and implementation of Mediated Learning Experience (MLE), which is the third contributing factor. Although socio-cultural elements affect the development of cognition, and moderate the biology, the most humanizing factor resides in the third factor. MLE is produced by the presence of a human mediator, who by placing him or herself between the socio-cultural determinants and the biological organism modifies both the biological and socio-cultural elements of experience and existence. Vygotsky argued that the child must be exposed to his/her sociocultural context (Bodrova and Leong, 2007), and use language and human interactions to transform the learning into cognitive schemas. Feuerstein distinguishes himself from Vygotsky by placing more emphasis on the developmental contribution of the human interaction to achieve cognitive functioning, and ultimately a more “unlimited” scope of modifiability.

“The readiness of the individual, and his/her capacity to benefit from exposure to the stimuli is strongly dependent on the nature of the MLE to which the individual is exposed.” (Feuerstein et al. 2006, p. 26) “The human interaction of MLE, the necessary vehicle to facilitate the human propensity for transformation, is the catalyst for human experience” (Feuerstein et al., 2006, p.26).

Human intelligence, within the theory of Structural Cognitive Modifiability (SCM), is not solely determined by one’s genetic endowment but rather it is characterised by the possibility to become meaningfully changed by experience. Thus, intelligence is defined as comprising specific skills, which has the propensity for intervention, thus providing the basis for change. Modifiability does not just refer to remediation of specific behaviours but changes of a structural nature that is durable, meaningful and substantial (Feuerstein et al., 2006). In the Feuerstein perspective, intelligence is made up of largely content free conditions of operational activities.

Therefore intelligence is considered a reservoir of universal cognitive functions that can and should operate perfectly in any content situation.

2.4.6 Cognitive Functions

Cognitive functions have been defined as “process variables that are themselves compounds of native ability, attitudes, work habits, learning history, motives, strategies”(Arbitman-Smith, Haywood & Bransford, 1984, p.434). These basic cognitive functions were identified primarily through clinical work with children who had learning or social problems (Haywood, Brooks and Burns, 1992). Cognitive functions are mental conditions essential to the existence of thinking operations and any other behavioural function (Feuerstein et al., 2006). Cognitive functions are seen to underlie internalised, representational, and operational thought, but they are not equivalent to operations and contents of thought. In other words, they can be considered as prerequisites of thinking and learning (Feuerstein, Hoffman, Egozi, Shachar-Segev, 1994). Specifically, they can be organised according to three phases of the mental act; namely the input phase, the elaboration phase and the output phase. This will be elaborated in the subsequent paragraphs.

In the Bright Start Cognitive Curriculum programme, the features of the programme attributable to Feuerstein include the concept of generalisable cognitive functions and the modifiability of these functions. The core of the Bright Start Cognitive Curriculum is made up of cognitive instructional units such as self regulation, comparison, role taking, number concepts, classification, sequence and pattern and letter-shape concepts. These are units which address the fundamental aspects of children’s cognitive functioning and learning skills, which are prerequisite for effective learning. The cognitive functions and processes are identified and emphasized in each lesson, and the teacher facilitates the children’s application of these cognitive functions and processes in other contexts through small group lessons and bridging discussions that occur within each lesson.

According to MLE theory, 'deficient cognitive functions' are considered as resulting from the lack of, or insufficient, MLE (Feuerstein, Rand, Hoffman & Miller, 1980; Rand, 1991). Deficient cognitive functions are responsible for poor cognitive performance in general. In particular, they have been hypothesized to be responsible for the poor performance on traditional, standardised intelligence tests (Feuerstein, Rand & Hoffman, 1979).

Feuerstein categorised the cognitive functions according to the three major phases of what Feuerstein described as 'mental act' - namely input, elaboration and output. Although the 'mental act' is artificially separated into three phases, in reality, they do not necessarily occur separately. The input phase is where information or data is gathered in order to solve a task. The elaboration phase is where the information or data are being processed. The output phase is where the information or data is being communicated or presented (Mentis, Dunn-Berstein & Mentis, 2008).

Much of Feuerstein's work has to do with helping immigrant families settle and integrate into their new homeland of Israel. In particular, he and his colleagues worked with the orphaned and traumatised youths. He also worked with adolescents and children with learning disabilities (Fischer, 2005; Kozulin and Rand (Eds.), 2000). The cognitive functions in the three phases of the 'mental act' could provide a useful framework for understanding and developing mental processing. It is important to lay a foundation of efficient cognitive functions in typically developing children but these thinking skills require time to develop with adequate mediation. In early childhood, maturation plays an important role in the development of a child's cognitive functions. At this early stage of a child's life, the cognitive functions are emerging and mediation could play an important role in facilitating these functions. Hence, the cognitive functions may not be seen as deficient in preschool children.

Deficient cognitive functions in the input phase (Feuerstein et. al., 1980, p.73) include :

1. Blurred and sweeping perception
2. Unplanned, impulsive and unsystematic exploratory behaviour
3. Lack of, or has impaired spatial orientation, including the lack of stable system of reference, which impairs the organisation of space
4. Lack of, or has impaired temporal orientation
5. Lack of, or has impaired conservation of constancies (in size, shape, quantity, orientation) across variations in certain dimensions of perceived object
6. Lack of, or is deficient in the need for precision and accuracy in data gathering
7. Lack of, or is impaired in the capacity for considering two sources of information at once, reflected in dealing with data in a piecemeal fashion rather than as a unit of organised facts.
8. Lack of, or has impaired receptive tools and concepts that affect discrimination.

Deficient cognitive functions can be observed in kindergarten children in examples such as: a child who is impulsive will typically rush into tasks too quickly without giving appropriate attention to what is required or without adopting a methodical approach. This is illustrated in the child's use of Tangram shape tiles, where he/she has to use different shape tiles to form an object; i.e., to form the shape of a cat. The child randomly selects shapes and does not have a clear idea of which shapes to depict the various parts of the body of an animal; i.e., the shapes that best depict the head, the body of a cat. Or a child who has blurred and sweeping perception, giving little or poor attention to form, shape, size and space and unable to select relevant details. For example, a child has to look for hidden pictures of objects; i.e., spectacles, ring, watch, spoon, needle etc. in a big picture about going shopping with mum, but he/she rushes into the task quickly and without appropriate attention to details, is not able to find the hidden objects in a big picture. Or in another case, a child who experiences an impaired capacity for considering two sources of information at once tends to focus on and take into account only one of a variety of dimensions or alternatives and this is illustrated in the example where a child is given the instructions to choose a picture card of an object that is green and long from several picture cards (the correct picture card is that of a snake). The child is

not able to pick out the correct picture card that has the two dimensions, colour and shape, instead he focuses only on one dimension, the colour, and picks out the picture card of a pair of green shoes instead. The child has demonstrated that he is not able to integrate the two sources of information at the same time and picks out the incorrect picture.

Deficient cognitive functions at the elaboration phase (Feuerstein et. al., 1980, p.73-74) include :

- 1) Inadequacy in experiencing the existence of an actual problem and subsequently defining it.
- 2) Inability to select relevant, as opposed to irrelevant, cues in defining a problem.
- 3) Lack of spontaneous comparative behaviour or limitations of its appearance to a restricted field of needs.
- 4) Narrowness of mental field.
- 5) Lack of, or is impaired in need for summative behaviour.
- 6) Difficulties in projecting virtual relationships.
- 7) Lack of orientation toward the need for logical evidence as an interactional modality with one's objectal and social environment.
- 8) Lack of, or is restricted in interiorisation of one's behavior.
- 9) Lack of, or is restricted in inferential-hypothetical thinking.
- 10) Lack of, or has impaired strategies for hypothesis testing.
- 11) Lack of, or has impaired planning behavior.
- 12) Non-elaboration of certain cognitive categories because the necessary labels either are not part of the individual's verbal inventory on the receptive level or are not mobilized at the expressive level.
- 13) Episodic grasp of reality.

A child who has a lack of, or impaired in need for summative behaviour, is not able to link the events in a story and when asked what is the story all about, is not able to provide the key points in the story. A child who has difficulties in projecting virtual

relationships would not be able to apply a concept learned in one area to a different area. For example, in the Organisation of Dots exercise developed by Andre Rey (Sharon & Coulter, 1994), a child who is presented with an array of dots and required to draw lines between the dots to form geometric shapes such as a square and triangle, is not able to do so because he/she cannot 'see' the shapes or project the virtual relationships between the dots that form the shapes although the dots are clearly marked out. A child who lacks in spontaneous comparative behaviour has difficulties in saying what is similar and not similar about the two items.

Deficient cognitive functions at the output phase (Feuerstein et. al., 1980, p.74) include :

- 1) Egocentric communication.
- 2) Blocking.
- 3) Trial-and-error responses.
- 4) Lack of, or has impaired verbal tools for communicating adequately elaborated responses.
- 5) Deficiency of visual transport.
- 6) Lack of, or is impaired in need for precision and accuracy in communicating one's response.
- 7) Impulsive or acting out behaviour, affecting the nature of the communication process.

Examples of deficient cognitive functions at the output phase can be found in a child who displays blocking behaviours. For example a child who gives up trying to solve a problem and says " I don't know", even though there is evidence that the child has done some thinking and work on the task. A child who has impaired verbal tools has poor communication skills. For example, a child replies that the answer to the math problem is 4 but when asked to explain how did he/she derive the answer, the child says "I don't know how to say." A child who manifests impulsive or acting out behaviour may act inappropriately such as shout out or clown around and give careless answers.

The above basic cognitive functions are acquired through learning, both by the children's "direct exposure" to environmental events, including environmental feedback on their own behaviour, and by mediated learning experience (Haywood, Brooks & Burns, 1992) that is primarily conducted by parents, grandparents, or older siblings. In fact, this process of mediated learning is seen by Feuerstein as essential for the cognitive development of children. Inadequate mediated learning experience is likely to occur when there is emotional disturbance, sensory impairment, or in an impoverished environment (Haywood, Brooks & Burns, 1992). One must provide more MLE of a different quality and intensity for children who have cognitive or learning difficulties than for those who are not developmentally delay nor encounter other obstacles in their direct exposure to learning (Haywood, Brooks & Burns, 1992).

2.4.7 Theory of Mediated Learning

Cognitive structure develops in the child as a product of two modalities of interaction between the child and his/her environment by direct exposure to sources of stimuli and by what is termed as Mediated Learning Experience (MLE).

In direct exposure learning, the stimuli impinging upon the learner modify the behavioural repertoire, and create cognitive structures. The structures created bring about a potential for changes in the learner's response to the environment, even when the environment is constant and stable. This is consistent with stimulus-response theories (behaviourism) in Figure 2.1. For direct exposure learning to occur, the learner must be ready to accept the stimuli. The learner's needs, skills, responsive capacity and other attributes must be present in order for learning from direct exposure to be successful (Feuerstein et al. 2006).

Figure 2.1 The Stimulus- Response Model of Learning

Stimulus – **O**rganism – **R**esponse

In mediated learning experience in Figure 2.2, a human mediator, guided by intention and culture, selects, enhances, focuses and organises the world of stimuli for the learner according to a clear intention and goals for the learner's enhanced and effective functioning (Feuerstein et al. 2006). Through this process, the learner acquires behaviour patterns, awareness, and strategies that in turn become important ingredients that can be modified by further direct exposure to the stimuli. Thus, the learner acquires learning and strategies that have the potential to generalise to new and subsequent exposure to the stimuli of the world (Feuerstein et al. 2006).

Figure 2.2 The Mediated Learning Experience Model (Feuerstein et al., 2006, p. 69)

S-H-O-H-R

The SHOHR: The human mediator (H) is interposed between the stimulus (S) and the organism (O) and between the organism (O) and the response (R)

Feuerstein has maintained that adequate cognitive development is not possible without some degree of MLE provided by parents and/or other caregivers (Haywood, 1993). According to Feuerstein, the various conditions that have traditionally been thought of as “causes” of inadequate cognitive development, such as poverty, neurological impairment, emotional disturbance in the child or his parents, and low educational levels of parents are presented as correlates or “distal etiologic conditions” (Feuerstein et al., 2006, p.69). Inadequate cognitive development is found more frequently when these conditions are present than when they are absent, the conditions themselves do not cause inadequate cognitive development. Those distal etiologic conditions, are often but not necessarily, associated with inadequate MLE. Instead the “proximal” (immediate) source of inadequate cognitive development is the lack of adequate MLE. Feuerstein et al. (1980) have contended that when MLE is sufficient for the individual needs of particular children, adequate cognitive development will be the result, and that when

MLE is not sufficient, inadequate cognitive development will result. Thus, Feuerstein et al. (1980) have suggested that adequate cognitive development can occur in spite of such “distal” conditions as poverty, neurological impairment, mental retardation, emotional disturbance, and low educational levels, when there is adequate mediation of the fundamental cognitive functions to the children by more competent older persons.

On the other hand, inadequate cognitive development may occur despite favourable distal conditions when MLE is not sufficient to meet the individual development needs of particular children. Hence, MLE is a critical condition for adequate cognitive development. The position of Feuerstein et al. (1980) is that adequate mediated learning experience is less likely to be provided, for a variety of reasons, when families are economically and socially deprived than when they are economically and socially secure.

With MLE set in place, a learner can begin to think about objects and events in the world rather than being restricted to only dealing with them in their direct and concrete presence. MLE is thus seen to be the crucial ingredient that determines differential cognitive development, and ensures structural cognitive modifiability. The goal of the mediator is to enable the child/ learner to incorporate a great variety of orientations and strategies which also constitute the prerequisites for higher order mental operations into his/her behavioural repertoire (Presseisen & Kozulin, 1994).

2.4.7.1 Mediated Learning Experience (MLE) Parameters

Feuerstein has analysed the processes involved in Mediated Learning Experience and has outlined 12 parameters of MLE, of which the first three namely the mediation of intentionality and reciprocity, mediation of meaning and mediation of transcendence, distinguish an interaction as a Mediated Learning Experience rather than something else; i.e., direct instruction. These are intentionality-reciprocity, meaning and transcendence (Feuerstein et al. 1980; 2006).

- 1) Mediation of Intentionality and Reciprocity/ What?** - The mediator uses the interaction to produce cognitive changes in the child. Content situations (eg. plants, living and non living things) become the vehicles for teaching and learning concepts and principles of thoughts, which produce cognitive changes in the child. The mediator not only has a clear intention to mediate the stimuli but also demonstrates and shares the interaction to the learner and ensures that the learner is indeed responding to the intervention (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 2) Mediation of Communication of Meaning/Why?** - It is important to let the children know ‘why’ one is doing any particular activity and ‘for what’. Mediators communicate both the immediate (content) meaning of events and their generalised relationship to other events (eg. why do you think it is important for us to do this? Yes, so we will have a plan, and know what to do as we go along.) Meaning is one of the powerful motivators. The mediation of meaning calls for teachers to play a role in helping children develop positive goals and healthy life aspirations (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 3) Mediation of Transcendence/ Where?** - Mediation leads the learner away from the “here and now”. It is about facilitating the application of learning across situations and contexts as well as developing a mental paradigm that would be future-oriented and farsighted. The mediator will give an event transcendent (generalised) meaning by attempting to relate the event to previous and even future events of a similar nature, and thus to extract a generality (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 4) Mediation of a feeling of competence** - Mediators communicate about this in two ways: a) reward appropriate responses, especially process-oriented responses, with acceptance, praise and acknowledgement. b) children understand exactly what aspects of their behaviours were good and should be

repeated, eg. “Good, you made a plan, so now you know what to do as you go along.” (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).

- 5) **Mediation of regulation of behaviour** - A good mediator helps children to inhibit their impulsive responding and thus improve the quality of their responses and unlock available responses, to be willing to give answers, by creating an affectively safe and expectant environment (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 6) **Mediation of sharing behaviour** - Mediation is needed to foster participation with others, sharing thinking, communication and emotional responses. This is closely associated with reaching out to others. Mediators convey the attitude that they and the children are engaged in a shared quest for structural cognitive change in the children. Each has an identifiable and yet separate role, but each is a participant and shares in the process (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 7) **Mediation of individuation and psychological differentiation** - Can best be developed by a process of mediation which is preceded and accompanied by sharing behaviour, meaning, transcendence and all the emotional engagement underlying MLE. Children’s whose level of security is increased by a process of bonding and mediation show much better capacity to perceive themselves as separated, articulated and independent entities with emotional ties which persist above and beyond the spatial temporal separation (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 8) **Mediation of goal seeking, goal setting and goal achieving behaviour** – Goal setting looks beyond the immediate and helps the individual harness the tools and energies for reaching goals (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).

- 9) Mediation of challenge, the search for novelty and complexity** – This is best done by allowing the individual to confront the novel situation in a gratifying way and to refrain from overprotection of the individual (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 10) Mediation of awareness of the human being as a changing entity** - There is a need to mediate the individual to believe that change and adaptability is possible. Parents who point out to a child the changes which have occurred in him following certain events, sensitize him to the need to be active in pursuing the goals of development and improvement (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 11) Mediation for the search of an optimistic alternative** – Knowing something is possible makes the individual committed to search for ways to turn the possible into materialized experience. It helps the child to anticipate positive outcomes (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).
- 12) Mediation of feeling of belonging** – Establish security and stability (Haywood, 1993; Deutsch, 2003; Feuerstein et al. 2006).

In summary, Feuerstein's theories of cognitive modifiability and mediated learning have generated applications across many contexts which include interactions between adult and child in early intervention and between teacher and children in the classroom settings and in the assessment of children. All the above intervention programmes' assessment are centred on a common philosophy, that is, a person's cognitive structure has every chance of modification and positive development through mediated learning experience.

2.4.8 Other works developed from Feuerstein's theory :

1) Feuerstein's (1980) Instrumental Enrichment (IE) programme, a widely used programme for cognitive skills training, is one of the works that comes out of his

theory of structural cognitive modifiability. The programme is intended to improve cognitive functions related to input, elaboration and output of information for older children. It specifically targets the cognitive deficits based on a list of deficient cognitive functions found in the three phases of mental processing, presented earlier in section 2.4.6. The materials of the IE programme are structured as a series of units, or instruments, each of which emphasises a particular cognitive function and its relationship to various cognitive deficiencies. IE is designed as a programme to intervene in the cognitive processing of learners.

A number of studies on the programme found moderate gains on intelligence items which are closely related to the IE programme and very limited and modest gains on certain achievement measures of IE were reported (Arbitman-Smith, Haywood & Bransford, 1984; Haywood & Arbitman-Smith, 1981; Shayer and Beasley, 1987).

Blagg (1991) evaluated the use of IE programmes in four secondary schools in southwest England with 14-year-olds with a mean IQ of 92, who showed below average verbal reasoning and vocabulary skills as well as low reading and mathematics achievement. The results of the programmes were mixed. There were positive behavioural improvements in pupils such as they became more active contributors to class discussion. They were more inclined to listen and very likely to defend their opinions on the basis of logical evidence, other positive improvements included being more able to describe different strategies for solving problems, to handle two or more sources of information simultaneously, to make spontaneous links between ideas and principles in different curriculum areas and more likely to spontaneously read and follow instructions carefully. However, there were no significant improvements in reading skills, mathematics skills, work study skills or was there any evidence of improved cognitive abilities as measured by the British Ability Scales.

In his critical review of Blagg's study, Haywood (1992) argued that Blagg's implementation had some serious gaps and these were found in teacher training,

supervision and the amount of IE instruction received by the students. Kozulin (1993, as cited in Kozulin & Presseisen, 1995) indicated that the amount of IE instruction, the quality of mediation provided by the IE teachers and the presence of bridging exercises to content areas of curriculum contribute to the success in IE implementation.

In summary, there have been mixed outcomes in the application of Feuerstein's theory of cognitive modifiability theory and the mediated learning experience approach. This may suggest a need to direct specific focus on the transfer and generalisation of the cognitive skills; i.e., to bridge the application of these skills into curriculum content areas. It could also suggest that the teachers need to spend more time to plan and support the implementation of mediated learning experience .

2) Mediational Intervention for Sensitizing Caregivers (MISC) by Pnina Klein

Based on Feuerstein's theory of cognitive modifiability and theory of mediated learning, Klein (2003) has identified the most salient elements of interaction between a caregiver and a young child. These are: focusing, corresponding to Feuerstein's intentionality and reciprocity; affecting, corresponding to Feuerstein's mediation of meaning; expanding, corresponding to Feuerstein's transcendence and finally rewarding, corresponding to Feuerstein's mediated feeling of competence. Klein incorporates this into her MISC programme. The factors of quality mediation have been found to predict cognitive outcome measures up to four years of age better than the children's own cognitive test scores in infancy (Klein, Wieder & Greenspan, 1987). Similar findings were reported for a sample of infants with very low birth weights (Klein et al., 1987).

MISC is an approach to early intervention, which is based on the identification and enhancement of basic criteria of mediation in adult-child interaction (Klein, 2003). This early intervention programme aims to promote a sound, facilitative caregiver-child relationship. MISC is based on the integration of three major theoretical

frameworks: an ecocultural approach, a developmental approach and a mediational approach (Klein, 2003).

In the Bright Start Cognitive Curriculum programme, the use of Feuerstein's MLE teaching style, characterised by mediating to the children basic thinking skills and metacognitive processes and enabling them to apply the thinking skills in different contexts, are the most important and distinguishing characteristics of the teaching approach and teachers' behaviours in this programme. In planning and conducting the Bright Start lessons, teachers who adopt mediational teaching style are required to follow several guidelines and this include focusing on processes rather than on responses, asking process questions and eliciting process answers that require justification, bridging cognitive functions/principles to many familiar content domains, and relating new learning to familiar experiences.

2.4.9 Criticisms of Feuerstein's work :

Feuerstein's work on cognitive modifiability which states that "all human characteristics, including personality, cognition, and behaviour are modifiable states, regardless of etiology, age, or severity of the condition" (Feuerstein and Rand, 1997, p. xxv), is progressive and promising. To date, the concept has been applied with great enthusiasm and success, especially in the area of intelligence and mental retardation (Feuerstein et al., 1994). However, his work is not without its critics.

Feuerstein has been criticised for his 'imprecise definition' of cognitive modifiability. His definition can be confusing and misleading (Frisby and Braden, 1992). Referring to Eysenck's (1988 cited in Frisby and Braden, 1992) definition of intelligence, comprises of three interrelated concepts and they are biological intelligence, psychometric intelligence and social intelligence, critics suggest that further clarification on Feuerstein's cognitive modifiability is needed to ascertain which level of intelligence he refers to. Social intelligence, the ability to function and adapt within social or everyday situations according to the accepted standards of

one's culture, can be modified substantially. However this 'modifiability' must not be confused with psychometric intelligence, a person's general functioning on objective, standardised intelligence tests or biological intelligence (Frisby and Braden, 1992). Whilst Feuerstein et al. (1979) has argued that differences in cognitive performance among individuals and groups are direct consequences of exposure to MLE or the lack of it. Although biological, social and environmental factors are acknowledged as distal causes of intellectual differences among groups and individuals, the immediate factor that affects the intellectual performance is assumed to be the lack of Mediated Learning Experience (MLE). According to Frisby and Braden (1992), based on the principle that an individual's response to treatment, does not necessarily imply causality. Similarly, a cognitive function that was deficient initially but has been remediated by MLE does not necessarily mean that the deficiency was caused by the lack of MLE. Attempts to draw links between ethnic/social class group differences in cognitive performance and associated differences in childrearing styles cannot prove or disprove an ad hoc MLE hypothesis, because such accounts do not control for genetic kinship, environmental or school factors.

Another criticism of Feuerstein's work is the organisation of cognitive functions to three phases of the mental act; namely the input phase, the elaboration phase and the output phase. According to Mosely et. al. (2005), the phases comprise a mixture of skills, knowledge, ill-defined structural characteristics, such as 'narrow mental field' and behaviours. The elaboration phase, in particular, does not include higher order thinking skills of synthesis, evaluation and creativity.

2.4.10 Investigator's reflections

The teaching of thinking is not just the impartation of the skills, but for thinking to take place, one need to pay attention to a child's social emotional development, motivation and dispositions to learn, creative development, linguistic development and reflective responses (Walsh & Gardner, 2005). In the light of this, Feuerstein's work appears to be rather narrow in focus, giving attention to the development of

thinking skills and there is inadequate focus on the other contributing factors to successful thinking highlighted by Walsh and Gardner (2005).

Further, McGuiness (1999) elaborated that a framework for teaching thinking encompasses several key components such as creating dispositions and habits of good thinking, moving beyond a narrow focus on skills to include thinking curricula, thinking classrooms, and thinking school is necessary. Here again, Feuerstein's thinking programme is designed with the focus on the elements of thinking processes but lacks the broader framework of teaching thinking such as creating habits of good thinking, cultivating a thinking classroom and thinking school, in contributing to the learning outcomes.

2.4.11 Teacher-child Interaction in the Development of Children's Cognition

Two key underlying theories in the Bright Start Cognitive Curriculum, Vygotsky's and Feuerstein's theories discussed earlier, emphasise the fact that children's cognitive development is socially mediated. "Social relations or relations among people genetically underlie all higher functions and their relationships." (Vygotsky, 1981 as cited in Mercer and Littleton, 2007, p. 163). According to Vygotsky, processes of interaction between the child and others at the 'intermental level', become the basis for processes that subsequently become internalised as intramental reflection and logical reasoning (Mercer & Littleton, 2007). Learning and development are seen both as interpersonal and intrapersonal where the child's cognition is developed through interaction with others. It appears first on the social plane and then on the psychological plane. Feuerstein went beyond Vygotsky's notion of the social agents or humans functioning as carriers of symbols, signs and meanings (Kozulin & Presseisen, 1995). He went on to elaborate on the activities of the social agents or humans introduce in his theory of mediated learning which are crucial in facilitating the development of cognition in children.

The importance of teacher-child interactions for children's development has both theoretical and empirical support. When exploring interactions between teachers and

children, researchers have observed key teacher's behaviours that enhance relationships with children and support social and academic competence. Teachers who have high quality relationships with children help children to focus their attention and interpret their emotions (Howes & Hamilton, 1992). Sensitive and responsive teachers assess children's learning styles and use that knowledge to meet children's instructional and social needs (Hamre & Pianta, 2005). Research also emphasise the importance of intentional, responsive teaching for children's learning in the context of play (Lobman 2006). Responsive teaching involves assessing children's individual needs, contextual needs and cognitive and social competencies and responding in a timely and appropriate manner.

Kontos and Wilcox-Herzog (1997) have found dimensions of interactions that impact upon children's cognitive, social, emotional and language development. These include firstly, roles such as socialising, encouraging play, monitoring for safety, managing misbehaviour. Secondly, they also include sensitivity or detachment of the teacher characterised by actions like being warm, attentive and quick to comfort or detached, unresponsive, harsh, critical or quick to punish. Thirdly, there is also the involvement of the teacher characterised by behaviours such as responsivity of teachers, holding, hugging, providing comfort, interacting in play or prolonged conversation. Finally, they include teacher talk characterised by the frequency, use of directives, questioning, expression of feelings and attitudes.

Vygotsky emphasised in his theory that language is fundamental to the process of learning. The complex interplay between language and thought in shaping meaning is at the heart of how classroom talk promotes learning and thinking (Myhill, 2006). Talk is both 'a medium for teaching and learning' and 'one of the materials from which a child constructs meaning' (Edwards & Mercer, 1987 as cited in Myhill, 2006, p.21). Hence, talk is not only a product that can be formally assessed but also a process, a tool for learning. According to Alexander (2007) talk has always been one of the essential tools of teaching. But talk is much more than an aid to effective

teaching, it is the foundation of learning. Children need to talk in order to learn and think.

Alexander (2007) has advocated the use of dialogic teaching to harness the power of talk to engage children, stimulate and extend their thinking, and advance their learning and understanding. Dialogic teaching is characterised by the following :

- collective, where teacher and children address learning tasks together, whether as a group or as a class.
- reciprocal, where teachers and children listen to each other, share ideas and consider alternative viewpoints.
- supportive, where children articulate their ideas freely, without fear of embarrassment over wrong answers, and they help each other to reach a common understanding.
- cumulative, where teachers and children build on their own and each other's ideas and chain them into coherent lines of thinking and enquiry. And finally, purposeful, where teachers plan and steer classroom talk with specific educational goals in view.

Questions are a natural and necessary part of the teacher's linguistic toolbox. In the Bright Start Cognitive Curriculum, questioning is an important component in eliciting children's thinking. According to Mercer & Littleton (2007), teachers' questions can serve useful functions in the development of children's learning and their own use of language as a tool for reasoning. They can:

- encourage children to make explicit their thoughts, reasons and knowledge and share them with the class.
- model useful ways of using language that children can appropriate for use themselves, in peer group discussions and other settings (such as asking relevant information, or asking why questions to elicit reasons)

- provide opportunities for children to make longer contributions in which they express their current state of understanding, articulate ideas and reveal problems they are encountering.

Rojas-Drummond and Mercer (2004) used video recordings of classroom interactions to find out if teachers were providing more effective scaffolding for students' learning. These include the use of questions, teachers' encouragement of students to talk together and the kind of explanations and instructions teachers provided to students for the tasks they set for them. They discovered that effective teachers use talk to guide learning in the following ways:

- question and answer sequences were used not just to test knowledge, but also to guide the development of understanding. These teachers often used questions to discover the initial levels of pupils' understanding and adjusted their teaching accordingly, and used 'why' questions to get pupils to reason and reflect about what they were doing.
- not just 'subject content' was taught, but more importantly, procedures for solving problems were taught to help children to make sense of their experiences. This included teachers demonstrating the use of problem-solving strategies for children, explaining to children the meaning and purpose of classroom activities, and using their interactions with children as opportunities for encouraging children to make explicit their own thought processes.
- learning was treated as a social, communicative process. Effective teachers used questions more for encouraging pupils to give reasons for their views, promoting exchange of ideas and mutual support amongst students and encouraging them to take a more active, vocal role in classroom events.

Although posing good and thought-provoking questions is important, teachers must also pay attention to children's answers to questions and decide what to do with those answers. There is little point in framing a well-conceived question and giving children ample 'wait time' to answer it, if teachers fail to engage with the answers

children give and hence with the understanding or misunderstanding which that answer reveals.

“If we want children to talk to learn - as well as learn to talk - then what they say probably matters more than what teachers say. So it is the quality of extension and cumulation which transform classroom talk from familiar closed question/answer/feedback routine into purposeful and productive dialogue where questions, answers and feedback progressively build into coherent and expanding chains of enquiry and understanding.” “The continuity and constant interplay between familiar and the new are prerequisites for development and growth in thought as well as language.” (Alexander, 2007, p. 26).

In the Singapore’s preschool context, most of the time, teachers are the ones who pose both closed and open-ended questions to elicit responses from the children and at the same time these questions serve to assess their understanding of the content. Hence, questions posed by the teachers tend to elicit answers that are related to naming and elaboration. Children tend to answer questions posed by the teacher and they rarely pose questions and participate in open discussions with teachers and peers. They appear not to listen to each other and they tend not to build upon one another’s contributions. Another typical feature in kindergarten classrooms here is children are given worksheets on counting and writing, and these worksheets focus on outcomes rather than on the process in deriving answers through discussions and problem solving in a collective manner.

The MLE teaching style of the Bright Start Cognitive Curriculum offers great pedagogical potential since its primary goal is to help children to construct effective thinking processes that are both durable and generalisable. This particular teaching style is primarily being carried out through the mode of classroom talk and discussions similar to what has been discussed in the four preceding paragraphs,

which is important for developing children's thinking skills. The characteristics of the style bears some resemblances to Alexander's dialogic teaching and Rojas-Drummond's and Mercer's discovery of how effective teachers use talk to guide learning. The MLE style of teaching (Haywood, 1985) includes:

- examining any interaction with children to determine to what extent they qualify and meet the fundamental parameters of mediated learning experiences.
- trying to elicit evidence of thinking from the children by asking questions directed at process rather than to answers.
- accepting to the fullest extent possible answers given by the children, and then taking the children a step beyond their answers.
- challenging answers, requiring justification and explanation of process. Correct answers are as likely to be challenged as incorrect answers.
- working to enhance the children's metacognitive functioning; i.e., making the children themselves become aware of their own thinking processes, asking children to think how they themselves would do things, to reflect on and analyze their own processes and strategies. Typically this means asking the children both to plan systematic approaches to problem solve and to summarise their cognitive processes and strategies after they have learned something or solved a problem.

Training in the Bright Start Cognitive Curriculum empowers teachers with the curriculum and the contexts to implement the curriculum and for MLE to take place. Specific cognitive functions that constitute the day's goals are carried across all content areas and through every period of the day; hence a consistent teaching approach is used throughout the day.

There is no doubt that teachers can make a powerful contribution to the development of children as collective thinkers, and hence also to children's development as individual thinkers (Mercer and Littleton, 2007). By the ways in

which they talk, act and structure classroom activities, teachers convey powerful messages regarding how learning, thinking and talking, which are intimately related, can be carried out.

2.5 Bright Start Cognitive Curriculum for Young Children.

Although the majority of the less successful learners have intact intellectual potential in terms of processing capacity, they do not know how to mobilise their processing capacity effectively.

“In fact, they can be distinguished from more successful learners by a whole group of cognitive and motivational deficits, including slowed development of general conceptual structures, lack of cognitive and metacognitive strategies, deficient use of cognitive, metacognitive, and communicational language functions, poorly organised representations of the utility of scholastic activities and of school itself, weaknesses of cognitive self-regulation, extrinsic motivational orientation and weak applications of executive control (self-esteem, expectation of self-efficacy, standard of internality).” (Paour & Cebe, 2002, p.137).

It is essential that any programme of cognitive education be able to show generalisable effects, preferably in the form of higher levels of school achievement and across a broad range of academic content areas (Paour, Cebe & Haywood, 2000). In general, it is reasonable to expect programmes of cognitive education to lead to first order effects in the form of improved logical thinking and reasoning, second order effects in the form of enhanced motivation to engage in learning tasks (resulting from the initially improved cognitive processes), and third order effects in the form of more effective and more efficient academic & social learning (Paour, Cebe & Haywood, 2000).

The Bright Start Cognitive Curriculum for Young Children is a programme of cognitive education designed for application in the classroom with children between 3 and 6 years of age. Originally developed for use with normally developing children from unfavourable social circumstances (eg. ethnic minorities, poor families, inner city residence) who are at high risk of school failure and following school entry, the programme has since been used extensively not only with such children but also with children with special needs, including those with mental retardation, severe emotional disturbance, sensory impairments, pervasive developmental disorders, orthopaedic handicaps, and multiple handicaps (Paour, Cebe & Haywood, 2000).

The specific goals of the Bright Start Cognitive Curriculum (Haywood, Brooks & Burns, 1992) are to :

- 1) enhance and accelerate the development of basic cognitive functions, especially those characteristic of the cognitive developmental stage of concrete operations
- 2) identify and remediate deficient cognitive functions
- 3) develop task-intrinsic motivation
- 4) develop representational thought
- 5) enhance learning effectiveness and readiness for school learning
- 6) prevent unnecessary or inappropriate special education placement

Throughout this curriculum, there is a heavy reliance on a MLE teaching style with the primary goal of producing structural cognitive changes in children, i.e., to help them to construct effective thinking processes that are both durable and generalisable (Haywood, Brooks & Burns, 1992).

The curriculum has five major components. These are a) MLE teaching style, b) the cognitive small group units, c) the cognitive-mediational method of behaviour management, d) content-oriented large group lessons; e) the parent education and participation component (Haywood, Brooks & Burns, 1992).

The small group units constitute the cognitive core of the curriculum. There are seven units in total, and each unit comprises of approximately 20 small group lessons, and each lesson takes about 20 to 30 min. for the teacher to address a fundamental aspect of the cognitive functioning of preschool children. The lessons are taught in small groups of about 10 children with a teacher trained in MLE teaching techniques and the Bright Start cognitive curriculum. Discussion of principles is encouraged, and the children work on related materials. The cognitive small group units are: 1) self regulation, 2) number concepts, 3) comparison, 4) role taking, 5) classification, 6) sequence and pattern and 7) letter shape (Haywood, Brooks & Burns, 1992).

Behaviour problems are seen as situations to be solved by systematic cognitive processes. Children become involved in the quest for more effective thinking processes, and this could lead to the increase in task intrinsic motivation and decrease in misbehaviour (Haywood, Brooks & Burns, 1992). A consistent MLE teaching approach is used throughout the day, whether the teachers are teaching counting or dealing with an explosive episode in the classroom.

In the Bright Start cognitive curriculum, teachers try not only to teach content but to teach the generalisation of cognitive functions to solve new problems that arise in different settings. In doing so, the teachers try to get the children to give examples of other times when a certain kind of thinking might be required or would result in better solutions, to discriminate appropriate and inappropriate applications of particular modes of thought, and to be critical of their own solutions, requiring logical evidence for their acceptance (Haywood, Brooks & Burns, 1992).

Large group lessons provide a framework for teaching specific academic content while simultaneously emphasising the cognitive functions that are being taught directly in small group lessons (Haywood, Brooks & Burns, 1992). Thus cognitive functions are learned and further reinforced when they are being applied in large

group lessons. The content is not taught for its own sake, in isolated bits to be committed to memory for successful performance and repetition in kindergarten; rather, the idea is to present content in a generalisable context and to teach children to generalise cognitive functions and cognitive strategies to other familiar and frequently-encountered situations (Haywood, Brooks & Burns, 1992).

One of the principal mechanisms of mediation is “bridging”, the activity by which cognitive concepts, principles and strategies are applied to familiar contexts (Haywood, 1988). It is in these applications that the concepts are learned and made secured to the extent that they are examined, tested, applied, and tried out in a variety of contexts (Haywood, Brooks & Burns, 1992). For example, in one of the Bright Start lessons on number concepts, the children are given opportunities to practise counting and identify cardinal numbers. Bridging in this lesson would include a discussion on how children use money, have them name the things that they have to pay for, what the storekeeper does with the money they give her or him, what storekeepers need to buy, and discuss other contexts when money is counted such as at the bank. In another Bright Start lesson on comparison on multiple dimensions, the bridging aspect of this lesson includes discussion on the different ways people can be compared, which of those ways might be important and to what extent choice of comparison dimensions depends on the purpose or the situation.

A parent component is the mechanism by which teachers try to extend classroom efforts to teach more effective thinking skills processes beyond the classroom. Parents observe in the classroom, then participate in the classroom teaching, attend periodic parent meetings, and are given activities to do with the children at home. These home activities are selected to extend the children’s understanding and generalisation of cognitive functions currently being explored in the classroom (Haywood, Brooks & Burns, 1992).

The next section provides a summary of the research studies that have evaluated the Bright Start Cognitive Curriculum approach.

2.5.1 Previous studies on the Bright Start Cognitive Curriculum

In the very first study of the effects of the Bright Start Cognitive Curriculum, Haywood, Brooks, & Burns (1986) had two groups of preschool participants: mildly to moderately learning disabled children and typically developing “high risk for failure” children (of poverty-level families, ethnic minorities, inner-city residents), both groups had the Bright Start Cognitive Curriculum for a duration of seven months of a school year. A second high risk control group, did not receive the Bright Start Cognitive Curriculum, but instead a good non-cognitive preschool programme, served as the control group. According to pre and post assessments with the McCarthy Scales of Children’s Abilities, the mild to moderately learning disabled children who learnt with the Bright Start Cognitive Curriculum, gained 12.15 points on the general cognitive index (equivalent to IQ mean of 100, standard deviation of approximately 15) and the high risk-children who learnt with the Bright Start Cognitive Curriculum gained 8.92 points, whereas the high risk control group gained 1.09 points.

One of the goals of the Bright Start Cognitive Curriculum is to help children avoid unnecessary and inappropriate placement outside the educational mainstream classes. A primary function of cognitive education in general is to “level the playing field” by equipping all children with the learning tools they will need to master the academic work of schools. Comparing the effects of the Bright Start Cognitive Curriculum during the kindergarten year versus a non cognitive preschool education programme, both with children who had severe learning difficulties, Samuels et al (Samuels et al., 1988 as cited in Brooks & Haywood, 2003), followed the school progress of the children after kindergarten. In one study, 24 children were independently evaluated by school psychologists, who then recommended the children’s first grade placement: either regular, mainstreamed classes or special education classes. On the basis of these independent evaluations and

recommendations, 9 of 12 Bright Start children were assigned to regular class and only 3 of the 12 to special education, whereas the proportions were exactly the reverse for the comparison children: 3 in regular classes, 9 in special classes. Given that all these children had been diagnosed with severe learning difficulties, special education placement for them might have been assumed to be virtually inevitable, the Bright Start Cognitive Curriculum experience had indeed helped them to cope with regular classes alongside their age peers rather than being segregated in special classes.

Paour, Cebé, Lagarrigue & Luiu (1993) used Raven's Coloured Progressive Matrices to assess individual differences in intelligence. Raven's Coloured Progressive Matrices is a normed referenced test for assessing reasoning ability, which requires making comparisons, perceptions and organisation of space, analytical perception of visual stimuli and analogical thinking. They had two experimental groups who learnt with the Bright Start Cognitive Curriculum and two comparison groups who learnt with a regular preschool education programme. The first comparison group, like the children from the Bright Start Cognitive Curriculum, consisted of immigrant children living in poverty-level homes with unemployed parents and speaking a different language at home. French was the medium of instruction at school. The second comparison group was composed of "metropolitan" French children, that is, of European ethnicity, born in France, and coming from relatively affluent families. The children from the Bright Start Cognitive Curriculum attained significantly higher scores than either of the comparison groups even children from affluent families.

They (Paour et al., 1993) also found that the Bright Start Cognitive Curriculum had significant effects on children's school achievement. The criterion variables included general knowledge and two tests of reading words given during the year following the Bright Start Cognitive Curriculum kindergarten programme. The comparisons were between low Social Economic Status children who learnt with the Bright Start Cognitive Curriculum and similar low SES children who did not.

On a test of general knowledge, the children from the Bright Start Cognitive Curriculum had mean scores that were significantly higher than those of the control children. This was also true on a test of reading familiar words. It was on a test of reading novel words, words that the children had not been taught and were unlikely to have encountered, that the difference was dramatically in favor of the children from the Bright Start Cognitive Curriculum programme.

Paour et al's (1993) study also included three tests of metacognitive control. This was assessed by two measures derived from the Mazes Test of Intrinsic Motivation (Delclos and Haywood, 1986). The children from the Bright Start Cognitive Curriculum were significantly superior to their low Social Economic Status (SES) control counterparts, but not to the high SES controls, on both measures: not crashing through the walls of maze and the number of correct choice-point decisions. A third metacognitive control measure was the ability to follow instructions in the various tasks. The children from the Bright Start Cognitive Curriculum scored significantly better than the low SES control children.

Two related studies were conducted by Tzuriel, Kaniel, Friedman and Haywood (1998). One assessed the influence of the Bright Start Cognitive Curriculum on the mediated learning teaching style of teachers (study1) while another, its effectiveness in developing children's "learning how to learn" skills and their task intrinsic motivation (study 2). The major objective of the first study was to investigate the effects of training in the Bright Start Cognitive Curriculum on the level of the MLE teaching style among teachers. Eleven kindergarten teachers, constituting the experimental group, were trained in the Bright Start Cognitive Curriculum and subsequently taught the programme for one year in their own classrooms. A group of teachers pair-matched to the experimental teachers did not receive the Bright Start Cognitive Curriculum training, nor did they teach the programme in their classes. These teachers were compared with the Bright Start teachers on MLE teaching style in two content oriented lessons with small group of children. The interactions were analysed by the Observation of Mediation Instrument (Klein,

1988) adapted for both age (children were older in Klein's original studies) and small group interactions. In the second study, a sample of kindergarten children randomly selected from kindergartens, constituted the experimental children, who participated in two units from the Bright Start Cognitive Curriculum , classification and seriation, for a period of three months. Using both static and dynamic assessment instruments, a total of 25 experimental children were compared with a control group of 26 children who were randomly selected from the same kindergartens but did not receive the Bright Start Cognitive Curriculum programme. The control children received a basic skills programme during the experimental period. Given that one of the major goals of the programme is to teach "learning to learn", it was essential to use dynamic tests in which change and improvement criteria could be assessed.

The findings of the Study 1 showed that the experimental teachers scored higher than the control teachers on all MLE criteria, though significant differences were found only for mediation of transcendence, which involves the building of bridges of thinking between experiences and events, and encouraging the child to consider implications and to make inferences (Lidz, 2003). This finding coincides with the emphasis given in the Bright Start Cognitive Curriculum programme on teaching of generalised rules and principles. It seems that the teachers internalised the MLE teaching style of the programme and used it later with their students in a different content-oriented context. The results of the implementation of a programme have indicated changes in not only the target population (children) but also in the change agents (teachers) who were responsible for modifying the children's functioning.

Despite the high variance among teachers, they did not mediate differently to high and low functioning children. Significant group differences in children's mediation were found in mediation for the transcendence criterion , but only among the high functioning children; the experimental group scored higher than the controls. The finding (Tzuriel et.al., 1998) might be explained by the fact that the experimental high functioning children internalised their teachers' mediation whereas low

functioning children probably need a more prolonged time to internalize the teachers' MLE teaching style.

The findings of Study 2 supported the programme's effectiveness. Children who participated in the Bright Start cognitive curriculum showed greater improvement both on static tests and dynamic assessment tasks than did the control children who did not receive this programme. The experimental group showed greater improvement on visual memory and concept formation from pre to post intervention. The experimental children benefited more from the mediation given to them within the dynamic testing situation than did the control children. The cognitive gains showed by the experimental group were impressive when only two out of seven units of Bright Start Cognitive Curriculum were implemented whereas the children in the control group were given a programme addressed to academic skills.

Although the use of verbal-logical skills were predominant in the programme, the experimental children could generalize from the mediational experiences and performed much better than the control children on the complex figure test, which is a visuo-spatial and memory skills test.

The findings on the picture motivation scale indicated that the pre to post intervention gains were not limited to the cognitive realm but were accompanied by changes in the children from the Bright Start Cognitive Curriculum to be more intrinsically motivated than the control group. The high scores of the experimental group can be attributed to the emphasis given in the Bright Start Cognitive Curriculum to self directed activities, expression of personal views, exploration of alternative solutions and reflective thinking and to the motivation that was produced by the children's perception of their own increased competence.

The results in Study 2 supported the argument that dynamic assessment measures should be used in cognitive intervention programmes. If the declared goal of the

intervention is to teach children how to learn, then, the outcome measures should tap precisely that goal. Many intervention programmes aimed at modifying learning skills do not employ dynamic assessment as a primary outcome measure.

Tzuriel, Kaniel, Kanner and Haywood (1999) studied the effects of the experience of a ten month Bright Start Cognitive Curriculum on low SES children in kindergarten and first grade, who had been randomly assigned to experimental and control conditions. The control children attended a skills based programme that emphasised basic academic skills such as reading, writing and math. In this study, the control children scored significantly higher than the children from the Bright Start Cognitive Curriculum on almost every criterion variable at the beginning of the study. Nevertheless, the latter closed the gap with bigger gains. The children from the Bright Start Cognitive Curriculum scored significantly higher on both visuo-spatial and memory performance.

The children from the Bright Start Cognitive Curriculum showed significantly greater improvement in cognitive development, knowledge of numbers, intrinsic motivation, and several dynamic assessment tests of cognitive functioning at the end of the school year. Similar to Paour et al's (1993) study, a follow up evaluation study was conducted one year after the end of intervention to determine the sustainability of these gains and to assess the effects on reading comprehension and mathematics achievement in first grade. The cognitive and motivational gains of the children who received the Bright Start Cognitive Curriculum were maintained with significantly higher scores than the control group on all cognitive measures.

In yet another study, Paour, Cebe and Haywood (2000) compared the effects of the Bright Start Cognitive Curriculum with those of the regular kindergarten programmes and followed the children through second grade. All these children were given a standardised national school achievement examination, prepared by the Ministry of Education, at the beginning of Grade 3. In the French test, 63 percent of children in a national sample of 2500 attained a passing score. Of the

high SES control children in the study, 67.6 percent attained a passing score. The percentages were 51.6 for children from the Bright Start Cognitive Curriculum and 41.8 for the low SES control. In mathematics, the percentages attaining a passing score were: national sample, 61.7 ; high SES controls, 59.2; Bright Start , 48.7; low SES controls, 36.6. This same pattern of superior achievement by the high SES control group, intermediate achievement by the Bright Start Cognitive Curriculum group and very low achievement by the low SES control group was repeated in all of the other areas of the examination: problem solving, reading (symbol system knowledge), written composition, number operations, geometry operations, spatial and temporal orientation. In one subject examined, the Bright Start Cognitive Curriculum group actually exceeded the performance of the high SES controls. In another subject examined, problem solving, the difference between them was very small. In 12 of the 13 comparisons, there were significant differences in favor of the Bright Start Cognitive Curriculum group, compared with low SES control group, with effect sizes ranging from 0.52 to 1.32. In this study, reading tests were given as early as the third month of Grade 1 and different tests at the end of Grade 1. On all six variables examined, the performance of the Bright Start Cognitive Curriculum group significantly exceeded that of low SES controls, with effect sizes ranging from 0.56 to 1.53.

Cebe and Paour (2000) evaluated the effects of Bright Start Cognitive Curriculum given at kindergarten on the subsequent acquisition of reading in primary grades. The subjects came from the same population that were sampled in the earlier studies conducted by Paour and his colleagues (1993, 2000). Comparisons were made of the Bright Start group, low SES control and high SES control groups in Grade 1 Inizan's (1983 as cited in Cebe and Paour, 2000) reading test across four sub scores-speed, dictation of words, reading novel words and comprehension. For each of the subscores, the mean score for the children from the Bright Start group was higher than the two control groups. The Bright Start group however did not perform better than the high SES control group in speed. This result was predictable because an

essential part of the Bright start method was teaching the children to work slowly but carefully.

In Grade 2, the children were given Bentolila's ARTHUR reading test (1989, as cited in Cebe and Paour, 2000) and Goigoux's (1993 as cited in Cebe and Paour, 2000) test of reading comprehension. The reading performance figures indicated that the children from the Bright Start group were consistently superior to those in the low SES control group and right up to Grade 3, and superior to that of high SES control group until Grade 3. At Grade 3, the high SES control children had caught up with the Bright Start children so that there was no significant difference between them in reading achievement. The low SES control group never caught up.

The durability of reading skills was seen in the fact that the children from the Bright Start group were still significantly superior to those in the disadvantaged control group more than 30 months after the end of the treatment (Cebe and Paour, 2000). The Bright Start cognitive curriculum's claim to focus attention on children's cognitive functioning, appeared to have helped the children to construct and elaborate some generalised abilities that could be used for more effective and efficient school learning (Cebe and Paour, 2000). On all the post tests, the children from the Bright Start programme had scores that were superior to those of the socially disadvantaged control children. Furthermore, their post-test performances, up to the end of third grade, were not different from those of the socially advantaged control children. One effect of the Bright Start cognitive curriculum, was to compensate for negative influences of social class, already visible at the children's entrance to kindergarten and during primary grades (Cebe and Paour, 2000). The vast majority of the children from the Bright Start programme learned to read better than did the control children from the same social class. The effects of the Bright Start Cognitive Curriculum on learning to read constitute a compelling indication of a generalised and 'far' transfer (Cebe and Paour, 2000). These effects were seen to be robust in as much as they were still observed three years after the end of the treatment.

The cognitive and metacognitive education promoted by the Bright Start programme has shown that the efficiency and effectiveness of school learning can be generalised and its effects were sustained after the end of treatment, the results show that it is possible to prevent school failure when children at the preschool age are equipped with the cognitive skills to help them to learn better and apply their learning more effectively to a range of new academic knowledge in formal schooling.

Cebe & Paour's (2000) study also found that when compared on Raven's Coloured Progressive Matrices in kindergarten as well as first to third grade, the low SES immigrant children who participated in the Bright Start Cognitive Curriculum during kindergarten scored significantly higher than the comparison group (low SES immigrant and high SES non immigrant group) at first and second grades and significantly higher than the low SES immigrant group at third grade, as well as in magnitude of gain from kindergarten to third grade. The significance of this finding is further underscored because the children did not undergo special programmes after kindergarten.

2.5.2 Summary of Findings :

From this review of the Bright Start curriculum and the research that has been done on its effectiveness, it is possible to conclude that: first, when systematically applied by teachers who have been trained in its method of delivery, this programme has positive effects on IQ. The authors' interpretation of the IQ data is that cognitive early education helps children to gain access to the intelligence that they already have and to apply their intelligence more effectively and efficiently to new learning (Brooks & Haywood, 2003).

Second, the programme's positive effects on cognitive functioning and development itself have been well demonstrated. These effects on cognitive functioning appear

also to be durable, which is a good basis for inferring that development itself has been influenced (Brooks & Haywood, 2003).

Third, the ultimate criterion in studies of the effects of early education is subsequent school achievement. The studies reported here demonstrate convincingly that a programme of cognitive early education can have generalisable and sustainable effects on school achievement across a variety of academic subject areas (Brooks & Haywood, 2003).

Fourth, the Bright Start Cognitive Curriculum served to 'level the playing field' for children with learning difficulties so that they can be educated in regular classes and avoid unnecessary and inappropriate special education placement.

2.5.3 Criticisms of the Bright Start Cognitive Curriculum

A major criticism, from the investigator's point of view, of the previous studies of the Bright Start Cognitive Curriculum is that there appears to be a lack of family involvement in supporting the children's learning in the programme. In the Effective Provision of Pre-school Education (EPPE) project that investigated the effects of the preschool education and care on the development of children from three to seven years of age, researchers Sylva, Melhuish, Sammons, Siraj-Blatchford & Taggart (2004) emphasised that children's outcomes are the joint product of home and preschool and any research on the effects of early education will have to take into account influences from the home.

While the developers of the Bright Start Cognitive Curriculum took a holistic perspective in attempting to integrate the cognitive, linguistic, behavioural and social domains in designing the programme through the cognitive units (Pou & Lam, 2003); the outcomes of the programme however, were predominantly on the development of cognitive functions and overlooked other critical aspects of child development, such as social-emotional domain, evident in most of the previous studies of the Bright Start Cognitive Curriculum reviewed in section 2.5.1.

2.5.4 Challenges faced in the implementation of the Bright Start Cognitive Curriculum

Over the years, early intervention research has raised caution about taking promising demonstration programmes to a larger scale (Hyson, Copple & Jones, 2006). A point made repeatedly is that most positive long term effects of early intervention have been found in programmes that were essentially demonstrations in nature, often linked to major research centres, such as the Perry Preschool project (Schweinhart, et al., 1993). These and other demonstration programmes were typically in one setting, with close involvement of the curriculum developers and highly trained and committed teaching staff and ongoing evaluations. Some specific curriculum models have been scaled up with positive results, such as High Scope curriculum. This, however, has taken extensive development and revision of print resources, teacher training materials, training of trainers, assessment tools and other supports for the implementation (Hyson, Copple & Jones, 2006). Similarly, the Bright Start Cognitive Curriculum research studies were carried out with close involvement of academic staff from universities with teams of highly trained teaching staff. Subsequently, there has not been any further development nor revision of the existing curriculum.

The Bright Start Cognitive Curriculum requires teachers to be well trained in mediated learning experience and the curriculum itself and requires a high level of theoretical understanding and pedagogical insight. It assumes a high degree of buy in and commitment on the part of the teacher, which makes it difficult to quickly and simply communicate the essentials to a wide range of teachers and administrators. In the current climate of limited time and budget, preschool centres are often inclined to adopt a curriculum that seems easier to implement on a large scale without a great effort.

Ramey and Ramey (2004) provided some possible reasons for intervention programmes that were initially implemented in community settings with public or private funding and subsequently were not continued. One of the key reasons was

the programmes have not been able to provide pre-service and in-service training for teachers to implement the curriculum successfully. Unfortunately, this is found to be true for the Bright Start Cognitive Curriculum programme where there has been few pre-service and in-service training for teachers in the curriculum to ensure that this programme is being more widely adopted by early childhood educators.

In the Singapore context, training of teachers in the Mediated Learning Experience teaching approach and in the Bright Start Cognitive Curriculum, as well as the successful implementation of the curriculum will require time and commitment from the teachers and preschool operators. This is a challenge for preschool educators in a fast paced and result-oriented society such as Singapore. According to Green (2006), a necessary precondition for any effective cognitive education programme is that the teachers must first be “thinking teachers” themselves. They need to be aware of their own thinking processes and predisposed to think and reason. The time it takes for teachers to internalize and implement cognitive approaches is very often underestimated by many, resulting in the inadequate implementation of the curriculum (Haywood, 1992).

Furthermore, programmes for young children require the involvement of families to be sustainable (Klein, 2003). In the previous studies of the Bright Start cognitive curriculum, it was not apparent that the families were involved in supporting the children’s learning in the programme.

2.6 Summary

In this Chapter, a literature review was carried out on the theoretical perspectives, as well as curricular that are prevalent among early childhood education today. It aimed to establish that there was a gap in the transfer of learning and there was a need to enable children to transfer their learning beyond the context in which the learning occurred. Set in the background of changes in the Singapore’s education system, it would be interesting to investigate if the Bright Start Cognitive Curriculum would be able to increase learning effectiveness and cultivate thinking

skills in young children. Subsequently, an overview of the theoretical background and the previous studies of the Bright Start Cognitive Curriculum were provided with the intention to establish a relationship between the proposed study and previous studies.

CHAPTER 3

METHODOLOGY

Introduction

This chapter examines the research approach and design, the methods and data gathering procedures and instruments used. Set against the background of reform initiatives in Singapore's education system to inculcate in children inquiring minds from an early age, the investigator sets out to examine if the benefits of Bright Start Cognitive Curriculum in enhancing children's cognitive functions reported in other studies (Paour et al., 1993; Cebé & Paour, 2000; Tzuriel et.al., 1998) applies in the Singapore's preschool context and how such a curriculum facilitates children's learning in the academic domain. Additionally, the investigator seeks to explore the effects of using MLE as teaching style among the teachers.

The research participants comprised of 43 children in the experimental group and 37 children in the control group from the kindergarten classes of five childcare centres from the same organisation, that cater to the working class families of low and middle income levels.

The experimental children had four out of seven units of the Bright Start cognitive curriculum and the control children had their regular integrated thematic curriculum. At the end of five months of using the Bright Start Cognitive Curriculum, the effects of the programme were compared with an integrated thematic curriculum by taking measures of them.

The teachers in the experimental group known as the experimental teachers in this study, have been trained in mediated learning teaching style and the Bright Start Cognitive Curriculum and they used this style of teaching in delivering the curriculum. The teachers in the control group, known as the control teachers in this study, have not been trained in mediated learning teaching style and the Bright Start Cognitive Curriculum. They carried out the regular integrated thematic curriculum with the children from the control group.

An experimental, pretest-posttest control group design was used and data were collected through a mixed method approach comprised of both quantitative and qualitative data. Qualitative data provide more information on the quantitative findings; thus providing the investigator with a richer understanding of the phenomenon in question. The combination of both quantitative and qualitative methods enabled the investigator to gain new insights, discover new concepts and detect the problems that exist. At the same time, it allowed the investigator to test the validity of claims within the local context. Video recordings of teacher-children interaction in the Bright Start Cognitive Curriculum sessions and the integrated thematic curriculum sessions can potentially offer qualitative information to add to the quantitative measures.

This chapter provides information on the research type, research context, research participants and instruments used for data collection.

3.1 The research type

Experimental research designs demonstrate cause-effect relationships where the changes in the independent variable produce resultant changes in the dependent variable (Mertler & Charles, 2005; Fraenkel & Wallen, 2006; Cohen, Manion & Morrison, 2000). The study utilised an experimental design to examine the extent to which the Bright Start Cognitive Curriculum yield gains in the cognitive functions of young children in facilitating their achievement in the academic domain compared with the regular integrated thematic curriculum. The children from the experimental and control groups came from centres where the regular integrated thematic curriculum was implemented. The experimental groups also received 30 to 45 min of daily session of the Bright Start Cognitive Curriculum for a period of six months from May to October 2008. The control group continued with the regular integrated thematic curriculum. Pre and post tests measures were taken to ascertain the effects of the intervention of the Bright Start Cognitive Curriculum on children's cognitive functions and academic achievement. The main method of data collection obtained from various quantitative measures, as

mentioned in section 1.6.2, followed by the use of video to provide additional information on teaching style and responses from children.

3.2 The research context

The study took place in five childcare centres randomly selected out of well over 30 ABC (fictitious name, used to preserve confidentiality) childcare centres in Singapore, see Figure 3.1. The organisation which runs the childcare centres seeks a variety of ways to enrich children's learning experiences and thinking skills. It has a long history of providing a variety of enrichment programmes to enhance children's learning. Children from both experimental and control groups participated in programmes such as speech and drama, and "Read to Reach" literacy programmes.

The ABC childcare centres provide full day childcare services with the operating hours from 7am to 7pm from Mondays to Fridays and from 7am to 2pm on Saturdays, to the working class or heartland population¹ who are at middle and low income levels. The age of children attending the childcare centres ranges from 18 months to 6 years of age and developmentally appropriate programmes are offered for the different age groups. The teacher-child ratio in each class varies according to the age group of children. The ratio ranges from 1: 3.5 for infants to 1:20 for the children at age 6. The total number of classes in each childcare centre ranges from five in a smaller centre to eight in a larger centre. Being a multicultural society, each childcare centre has children and teachers from different races: Malay, Chinese and Indian. English language is taught in schools and widely used as a working language and in general conversation. Children do speak their mother tongue at home and learn it in schools.

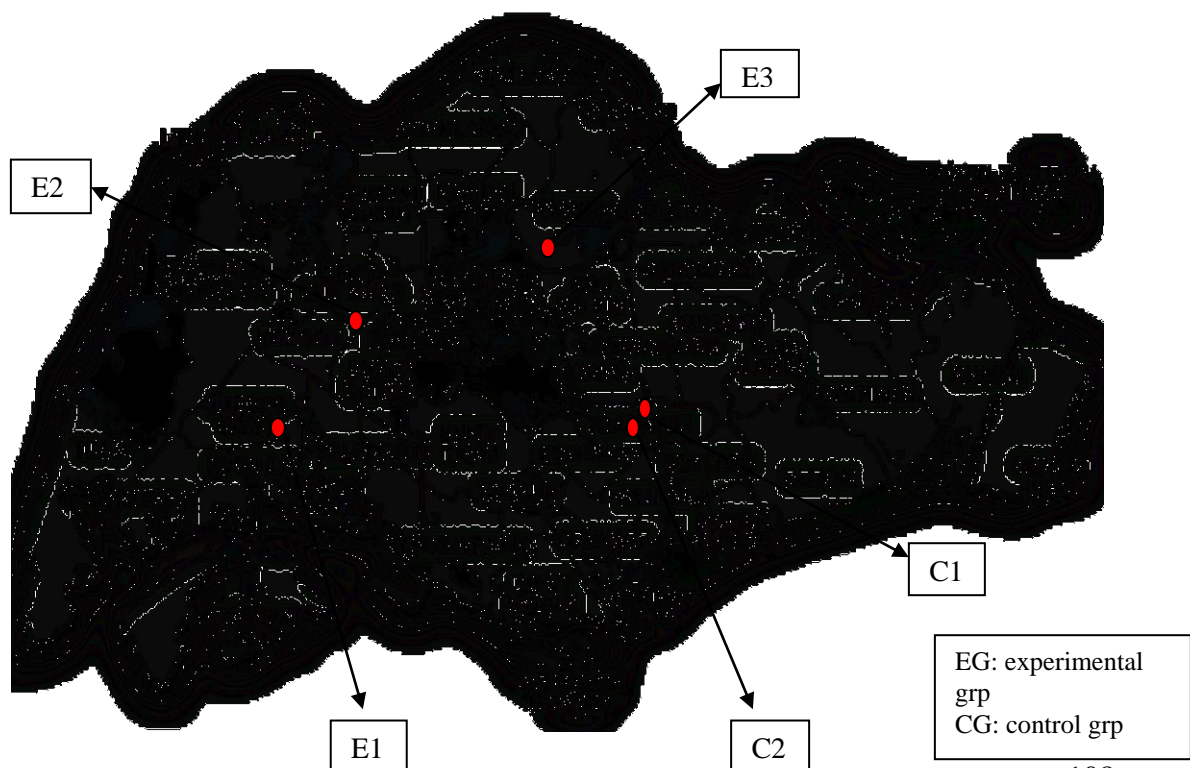
One of the main curriculum goals in ABC Childcare is to promote the growth of children in all areas of development: physical, social, emotional and cognitive through experiential learning and using an integrated approach, which is a common

¹ Ordinary Singaporeans who live in public housing estates built by the Housing Development Board. About 80% of Singapore's population live in such estates.

curriculum approach in preschool settings in Singapore. Activities at the centres encourage creative expression through music, art and drama, hands-on learning, field visits and computer-assisted learning. The classrooms are organised according to learning centres which include areas for art, reading, blocks, manipulatives and dramatic play. On a daily basis, children have opportunities to select activities they like to work with and spend blocks of uninterrupted time in the activities. In each childcare centre, there is also an outdoor play area with complex, multifunctional structures that includes steps, slides suspended bridges, ramps and climbers for the purpose of promoting children's gross motor and social development.

The teachers in these settings are trained in early childhood care and education at the certificate, diploma or degree level. The role of a teacher includes planning daily learning activities and environment, observe and document children's learning and progress, facilitate children's learning and work with parents and fellow colleagues in the centre.

Figure 3.1: Map of Singapore showing the locations of experimental and control groups



3.3 The research participants

Both teachers and children were randomly selected to “ensure the greater likelihood of equivalence apportioning out between experimental and control groups of any other factors or characteristics of the subjects which might conceivably affect the experimental variables in which the researcher is interested.” (Cohen, Manion & Morrison, 2000, p 213). Randomization of participants serves to eliminate the threat of additional variables that might affect the outcome of the study (Fraenkel & Wallen, 2006; Campbell and Stanley, 1966).

3.3.1 Sample of preschool teachers:

The Bright Start Cognitive Curriculum is implemented most effectively when teachers use mediated learning experience as a consistent style of interaction with the children. Six diploma-trained preschool teachers who have received 50 hours of training in mediated learning experience approach were selected. These teachers worked in different childcare centres within the ABC group of childcare centres. Three teachers were further randomly selected from the six teachers to implement the Bright Start Cognitive Curriculum. These three randomly selected teachers with the randomly selected children in their classes formed the experimental group. Two other teachers who have been awarded the same diploma in early childhood education and with the same number of years of teaching experience as the teachers who implemented the Bright Start Cognitive Curriculum were randomly selected from the rest of the diploma trained teachers who did not receive any training in mediated learning experience. These two teachers implemented the regular integrated thematic curriculum with the randomly selected children in their classes formed the control group. It is important to note that the five teachers (three in the experimental groups and two in the control groups) worked in five different centres of the ABC childcare group. The teachers in the control groups did not have any contact with the teachers in the experimental groups during the period when the research was conducted. This was to ensure that there was no contamination of data between the two groups (Campbell and Stanley, 1966). The two groups are shown in the Table 3.1. Take note that the teachers from the experimental group will also

be referred to as experimental teachers, and the teachers from the control group will also be referred to as the control teachers.

Table 3.1

Sample of preschool teachers:

Group	Number	Qualification
Experimental group	3	Each completed a 2-year diploma in early childhood education and received 50-hour of training in the mediated learning experience approach which underlies the implementation of the Bright Start Cognitive Curriculum for young children.
Control group	2	Each completed a 2-year diploma in early childhood education.

3.3.2 Sample of children:

The randomly selected children from the class of the experimental teachers made up the experimental group. These three classes consisted of 43 children in the experimental group (23 boys and 20 girls) and 37 children in the control group (20 boys and 17 girls). The age range of the whole sample was 67 months to 78 months, the mean age was 72.46 months and 72.89 months for the experimental and control group respectively. In Singapore's education system, children attend primary/elementary schools when they turn 7 years of age. The children were thus in their final year of their preschool programme in ABC childcare when this study was conducted. The two groups are shown in the Table 3.2.

Table 3.2**Structure and composition of experimental and control groups :**

Centres' Information	Group	No. of children		Gender		Mean age (in months)
		Group	No.	Male	Female	
Operating hours : 7am to 7pm Levels : infant to Kindergarten 2 Teacher –child ratio : 1. Infants (age 2 to 17 months) ratio - 1:3.5 2. Toddler (age 18 to 30 months) ratio- 1:8 3. Playgroup(age 30 to 36 months) ratio-1:12 4. Nursery (age 4 years) ratio-1: 15 5. Kindergarten 1 (age 5 years)ratio- 1:20 6. Kindergarten 2 (age 6 years) ratio-1:20	Experimental	EG 1	13	6	7	EG : 72.46 months
		EG2	16	7	9	
		EG3	14	10	4	
		Total :	43	23	20	
	Control	CG 1	23	12	11	CG: 72.89 months
		CG2	14	8	6	
		Total :	37	20	17	

As mentioned previously, the children from the experimental and control groups were randomly selected from the classes taught by the teachers who participated in this research study. Children in the ABC group of childcare centres generally came from middle and lower SES groups of the working class or heartland population in Singapore. English is usually not their mother tongue. Very often, a mixture of different languages is used at home where the children switch between their mother tongue, dialects and English. In the childcare centres, however, both groups of

children speak English language as well as their mother tongue. English is the official language medium of instruction. There is however a strong tendency for teachers to use Mandarin when communicating amongst themselves and also at times with the children.

3.4 Research ethics

One of the key ethical issues in relation to participants in a research study is seeking informed consent (Bailey, 1978). In this research study, the parents of the children participants were made adequately aware of the of the type of information that the investigator collected from them, why the information was sought and how the children were expected to participate in the study and how would this in turn affect them. Participants consented to joining the study on their own volition and were given the option to withdraw from the research study should they wish to discontinue.

The parents of all children in both the experimental and control groups gave their consent to the investigator for their child's participation in this research study. All except one parent approved their child's participation in the study. All the randomly selected teachers for both experimental and control groups also consented to participate in the study. There were two children; one from the experimental group and one from the control group, who withdrew in the beginning of the research study. This however was due to their poor attendance.

The nature and schedule of the implementation of the Bright Start Cognitive Curriculum rendered it no different from enrichment programmes that were offered by the childcare centres. Hence, the children in the control group were not deprived of the opportunities for enhancement which were readily offered by other enrichment programmes in the centres.

3.5 Procedure of the research study:

The pre tests and posts tests were administered individually by the investigator and a research assistant, who was a student in the faculty of psychology in the National Technological University. These tests included :

- Application of Cognitive Function Scale (ACFS) classification subscale (Haywood & Lidz, 2007), (refer to Appendix A).
- Raven's Coloured Progressive Matrices (Raven, Raven & Court, 1998) (RCPM),
- Brigance Diagnostic Inventory of Early Development (IED-II) Academic/Cognitive Domain standardised assessment (Brigance, 2008), (refer to Appendix B) and
- Brigance Diagnostic Inventory of Early Development (IED-II) criterion referenced assessment, known as Brigance 2 (Brigance, 2008) in this study (refer to Appendix C).

Observations were collected of the teachers' interaction with the children in both the experimental and control groups using the Guidelines for Observing Teaching Interaction (Lidz, 2003), see Appendix I. Data from the Children's Response to Mediation Scale (Lidz, 2003), see Appendix J, were collected from the experimental group and used as a form of triangulation of the post test data of the children. See Figure 3.2 for timeline of research study.

For the duration of the research study from May to October 2008, the children from the experimental group had the Bright Start cognitive curriculum on a daily basis for 30 min. to 45 min. in the morning and followed by a lesson from the regular integrated thematic curriculum. In the integrated thematic lesson, children learnt different content such as plants or animals, where the cognitive functions that they learnt from the Bright Start lesson would be further reinforced.

Children in the control group would have their lessons, see sample lesson in Appendix D, from the regular integrated thematic curriculum daily for

approximately 45 min. In the integrated thematic curriculum, the various subject areas such as language, math skills, aesthetics and creative expressions, and motor skills were addressed in the daily lessons and connected to a particular theme such as plants or animals. The lessons tend to focus on learning the content of the topic; such as the names, characteristics and functions of different parts of the plants.

Figure 3.2 Timeline for research study

Activities :	Mar 08	April 08	May 08	June 08	July 08	Aug 08	Sept 08	Oct 08	Nov 08	Dec. 08 onwards
Pilot tests (RCPM, ACFS, Brigance , Brigance 2) with children from the same age group as the ones in the study but in a non participating centre										
Conduct pre-tests (RCPM, ACFS, Brigance, Brigance 2) for experimental and control groups*										
Implementation of the Bright Start Cognitive Curriculum and data gathering of teaching sessions of the experimental group**										
On- going Implementation of regular Integrated thematic curriculum and data gathering of teaching sessions of the control group										
Conduct post- tests (RCPM, ACFS, Brigance, Brigance 2) for experimental and control groups										

Collation & data analysis										
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Note :

* Some disruption due to the outbreak of hand foot mouth disease

** The regular integrated thematic curriculum was still being implemented in experimental group as it was in the control group.

3.5.1. Description of Bright Start Units

Due to time constraint, such as the year end concert followed by school holidays, with children withdrawing from the kindergarten programme and transiting to primary one, four units out of a total of seven units in the Bright Start cognitive curriculum were implemented in this research study over a period of about six months from May 2008 to October, 2008. Each cognitive unit is designed to focus on enhancing the development of fundamental cognitive functions of preschool children. The units carried out in this research study were in the following order :

- 1) Self regulation,
- 2) Comparison,
- 3) Classification and
- 4) Number Concepts

Please refer to Table 3.3 for details of the four units delivered in my study.

Table 3.3

Description of the Bright Start units .

Unit	Description	Total Number of Lessons	Cognitive Functions
Self regulation	This is the first unit in the sequence of units because this is fundamental to successful learning.	28	-Comparison -Constancy -Hypothetical thinking -Labeling

	<p>According to Haywood, Brooks and Burns (1992), self regulation is an essential precognitive function. And in order to learn, the children must be able to manage , direct, order, sequence and control their own behaviours to some extent. This unit helps children to learn to focus their attention, respond appropriately to external stimuli and manage and direct one's body. Once self regulation is achieved, it is possible to direct one's thought processes in order to improve thinking, learning, problem solving and social interaction. Since self regulation is a necessary component of all the units, it is the first in the series of units where children will learn the level of expected behaviours and enable them to use self regulating behaviours in succeeding units (Haywood, Brooks and Burns, 1992).</p>		<ul style="list-style-type: none"> -Listening to and understand instructions/directions -Matching to a model (gross motor matching) -Mental imagery -Multiple sources of information (keeping two things in mind) -Precision and accuracy in expression (using precise language) -Precise and accuracy in input (gathering clear and complete information) -Relating past to present -Role taking -Selective attention (identifying and attending to defining criteria) -Self regulation -Self regulation according to instructions -Self regulation in response to external stimuli -Self regulation using symbols as clues -Spatial referents -Systematic exploration -Understand the concept of 'rule'

Comparison	<p>This unit is considered the foundation of cognitive processes because it is the basis for a wide variety of more complex operations. This unit introduces the concept that similarities and differences can be identified in a systematic way and this leads to definition and comparison of basic characteristics such as length, colour, shape and size (Haywood, Brooks and Burns, 1992).</p>	18	<ul style="list-style-type: none"> -Comparison -Comparison on multiple dimensions -Comparison to a model -Concept of rules -Constancy -Elaboration -Labeling -Precision and accuracy -Selection of appropriate model for comparison -Self regulation -Spatial referents -Systematic exploration -Understand and using clues
Classification	<p>This unit develops the children's ability to classify objects, people according to the dimensions of colour, size, shape and leads to representational classification (classifying without referring to pictures) (Haywood, Brooks and Burns, 1992). The goals of this unit include children learning to classify objects in different ways and provide a rationale for the classification.</p>	16	<ul style="list-style-type: none"> - Class inclusion - Classification -Classification and verbal abstracting -Comparison -Discrimination of relevant information -Grouping -Grouping and verbal abstracting -Labeling -Precision and accuracy -Seriation -Spatial referents -Systematic exploration

Number Concept	<p>The primary goal of this unit is to help children understand number concepts through the 28 lessons planned in the curriculum. As a prelude to the concept of number, this unit introduces the concept of correspondence, beginning with one-to-one correspondence. This is followed by the concepts of ordinal number, conservation, constancy and cardinal number. Counting is not taught as an end in itself but rather as a strategy to find out how many one has of something (Haywood, Brooks and Burns, 1992). The strategies in this unit will help children to develop a logical and organised manner in responding to their world.</p>	28	<ul style="list-style-type: none"> -Cardinal number -Comparison -Comparison by counting -Conservation -Constancy -Correspondence -Counting -Labeling -Naming the process of correspondence(‘one- to-one’, ‘matching’ or ‘corresponding’) -Ordinality -Precision and accuracy -Relating past to present experiences - Sequential enumeration -Systematic approach (going in order)
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3.5.2 Procedures for Implementation of the Bright Start Cognitive Curriculum lessons

One Bright Start lesson was delivered daily by each experimental teacher in the morning for 30 to 40 min. using the mediational teaching style approach, please refer to Appendix E for a sample of the Bright Start lesson plan. Each lesson was conducted according to the following features:

- Main activity, where the cognitive functions are being taught;
- Variation where the alternative activities for teaching the cognitive functions are presented;
- Generalizing activity, where the application of cognitive functions are encouraged in a general way;
- Bridging discussion and other bridging discussion where discussions were focused on how cognitive principles, concepts and strategies can be applied to different contexts and content.

The teacher was required to carry out all the components stated in the lesson.

In the later part of the day, when the experimental teacher conducted the regular integrated thematic curriculum, she emphasised the cognitive functions that were being taught in the earlier part of the day. The emphasis on the cognitive functions stems from the idea that these are better learned by applying them in other content learning areas. According Haywood (1988), this concept, where the cognitive functions and strategies are applied to other contexts, is also known as bridging. It is in these applications that the concepts are learned and made secure to the extent that it is examined, tested, applied and tried in a variety of contexts. At the end of each day, the teacher was required to evaluate the children's learning and her teaching of the daily Bright Start lesson and the integrated thematic curriculum lesson.

Next, further examination on how the Bright Start Cognitive Curriculum was woven into the daily schedule of curriculum implementation. The ABC curriculum integrated the various disciplines such as mathematics, environmental awareness, language, self and social studies, aesthetics and creative expression, and physical skills were embedded into the thematic curriculum. This stems from ABC Childcare's belief that children learn from everything that happens to them and do not separate into 'subjects'. Learning from one domain leads to learning in another domain. Hence, the children's learning experiences should therefore be integrated as a whole where possible. The integrated thematic learning helps children to understand that knowledge and skills are linked together rather than being

segregated in the teaching and learning process (Ministry of Education, 2003). Hence, learning these domains become more meaningful to children when they are embedded in the context of themes. For example, from May to October 2009, there was a unit on plants in the integrated thematic curriculum, where the children used comparison skills to compare the physical features of plants and another unit on animals required children to use classification skills to classify animals in their various categories. Both the experimental and control groups of children would have acquired comparison and classification skills as they learnt about the plants and animals in the integrated thematic curriculum. With the experimental group, the comparison and classification skills were taught explicitly in small group teaching and being considered as cognitive functions. The children from the experimental group had the advantage of having these skills further reinforced when participating in the thematic curriculum topics such as plants and animals.

3.5.2.1 Adaptations of the Bright Start lessons with the use of local materials

In the initial stage, the experimental teachers followed closely the Bright Start lesson plans. However, as they went along, the teachers felt that the Bright Start lesson plans offered guidelines and more was needed to help further enhance the children's cognitive functions and the application of cognitive functions. The experimental teachers made some adaptations as they delivered the Bright Start lessons. They introduced materials that were used in the local context. One such example is the Congkak board, a traditional game played by the Malay ethnic group (See Appendix K). It is made of wood and shaped like a boat with fourteen holes in two rows of seven. With the use of marbles dropped into the holes, this equipment was used by the teacher to teach estimation and counting. Another local traditional play material is Kuti- Kuti (please refer to Appendix K), these are small colourful transparent plastic pieces in shapes of animals and the teachers used them to teach counting and classifying skills. The children were learning to play "traditional games" which used to be played by their parents. It gave them an interesting insight to the early experiences of their parents, Gestwicki (1999) suggests that the knowledge of age-related developmental information about how children learn,

knowledge of individual children's abilities, characteristics and needs for support and knowledge of the cultural context from which each child comes from, must be given attention in planning truly developmentally appropriate programmes.

On the other hand, the curriculum that the control teachers used appeared to be prescriptive in nature. They followed a detailed manual of lesson plans with materials provided which were deemed to be adequate to cover the learning of the children for the whole school year.

3.5.2.2 Supplementary tasks to meet the developmental needs of the children

To meet the learning needs of the children, the experimental teachers supplemented the lessons with relevant tasks that required children to apply the various cognitive functions. For the cognitive unit on Self Regulation, the children were given the tasks of solving hidden pictures puzzle (See Appendix L) where they have to pay attention to details, develop figure-ground perception, establish object constancy and explore systematically in order to solve the puzzles.

For the unit on Number Concept, the children did some activities where they had to make reasonable estimates of quantities, such as pumpkin seeds, marbles etc. and check for accuracy. These activities require the children to use counting as a strategy in solving problems.

For the unit on Classification, the children's concept of classification was further challenged when they were asked to explain the specific attributes of a group; example, living and non living things and their reason for grouping items under the categories. One such classification activity was carried out using a matrix task (Stachel, 1973) (See Appendix L). The children had to keep in mind two properties of an object and search for it, thus children develop an understanding of the concept of classifying objects simultaneously based on two dimensions (Caruso & Resnick, 1972)

3.5.2.3 Problems encountered during implementation of the Bright Start cognitive curriculum in the setting of my research study.

There were a few problems encountered during the implementation of the Bright Start in the setting of my research study.

Firstly, the teachers in the experimental groups were relatively new to mediated learning teaching techniques. Although they have received a 50-hour of training in mediated learning teaching techniques and the Bright Start cognitive curriculum for young children, they were still considered as beginners in the use of the mediated learning teaching techniques and they would have benefited from more opportunities to practice. Hence, they experienced difficulties in reinforcing the cognitive functions in the integrated thematic lessons consistently and they were also not consistent in the use of meditational teaching approach except during the Bright Start cognitive curriculum small group lessons.

Secondly, the daily Bright Start lessons were disrupted towards the end of the research study because the children had to take time for their year end concert rehearsals. As a result of this, the Bright Start lessons were carried out twice or three times per week instead of daily in the month of October 2008.

Finally, there was an outbreak of hand -foot- mouth disease in April to June period of 2008 and this has disrupted my pre-tests schedule, which in turn, has caused some delay in the implementation and completion of Bright Start cognitive curriculum.

In the following sections of this Chapter, each research question will be stated, followed by description of the instruments, the validity and reliability of each instrument with reference to previous research studies, rationale for the choice of instrument for my research study, procedures used for data collection.

3.6 Cognitive Functions

Question 1) Which cognitive functions, if any, have been enhanced by the Bright Start Cognitive Curriculum?

3.6.1 Measures used for data collection on cognitive functions

The Bright Start cognitive curriculum is not accompanied by assessments that directly assess the effects on the cognitive functions that it sets out to develop in children. Hence, the following measurements were used :

- Application of Cognitive Function Scale (ACFS) classification subscale (criterion-referenced) ,
- Raven's Coloured Progressive Matrices (RCPM) (norm referenced) and
- Videos showing children's responses to teaching, to assess the children's acquisition of the cognitive functions through Bright Start cognitive curriculum.

3.6.2 Description of Application of Cognitive Function Scale (ACFS)

Educators have increasingly advocated assessment that reflects specific curriculum objectives to promote a close relationship between assessment and teaching (Fuchs and Fuchs as cited in Haywood and Lidz, 2007). The Application of Cognitive Function Scale (ACFS) was designed by Lidz and Jepsen (Haywood and Lidz, 2007) as a curriculum based dynamic assessment² for children who function between the ages of 3 and 5+ years. ACFS is grounded in the works of Feuerstein and Vygotsky in the area of cognitive development with the use of MLE to help children to develop cognitive functions. The ACFS taps basic cognitive processes and learning strategies that are associated with typical early childhood learning activities. Hence, there are six subscales that represent learning processes that are typically required for success in the preschool programmes included in the ACFS. They are :

1) Classification

² Dynamic assessment (DA) is most frequently characterized by the inclusion of interaction in the form of active teaching process aimed at modifying cognitive functioning during a testing situation. DA focuses on how the learner approaches tasks, the mental process obstructions and the types of interventions for promoting the mastery of tasks (Tzuriel, 2001; Lidz, 2003).

- 2) Short term auditory memory
- 3) Short term visual memory
- 4) Sequential pattern completion
- 5) Perspective taking
- 6) Verbal planning

Classification, a cognitive development of pre-operational children, is a basic process that children use to develop logical and mathematical reasoning abilities. It has been included in many assessments of young children's cognitive processes such as in OLSAT (Otis-Lennon School Abilities Test) and CogAT (Cognitive Abilities Test) where the reliability and validity of these measures include classification as an essential component (Motta & Joseph, 2000).

For the purpose of the research study, the investigator chose to administer the ACFS classification subscale only because the Bright Start Cognitive Curriculum has a unit on classification where the children learn simple classification of objects, reasons for classifying objects as well as different ways of classifying objects through mediation by the teacher (Haywood, Brooks & Burns, 1992). In the tasks stated in the ACFS classification subscale, children are required to group objects on the basis of abstracted features of size, colour, function and shape and change the basis of grouping objects when asked to do it another way (Haywood and Lidz, 2007). The objectives of the tasks in the ACFS classification subscale are similar with the learning objectives in the classification unit of the Bright Start Cognitive Curriculum (See Appendix A for the record of observation and scoring of the classification subscale).

The ACFS classification subscale was administered as a static assessment during the pre and posts tests to assess if the cognitive functions were applied when no mediation was given because children in the Bright Start Cognitive Curriculum were regularly and specifically mediated on the classification unit.

3.6.3 The use of ACFS in the studies of preschool children

ACFS has been used in studies where the participants were from a wide variety of socioeconomic and ethnic backgrounds. The first cohort of children assessed with the ACFS was a group of 30 high functioning children from pre-kindergarten and kindergarten levels who attended a private school in New York city (Haywood and Lidz, 2007). There was a significant pretest to posttest gains for the classification, auditory memory and visual memory for children from both grade levels.

Shurin's study (as cited in Haywood and Lidz, 2007) involved 26 four-year old children, where all but 5 with diagnosed developmental disabilities. The use of ACFS showed that significant gains were found for classification, perspective taking, verbal planning and sequential pattern completion subscales. The only two subscales that did not show significant gains were the two memory subscales. This difference would have diagnostic implications for differentiating children with and without developmental disabilities.

Lidz and Van der Aalsvoort (2005) completed a study which involved the administration of the four core ACFS subscales to 29 Dutch children between the ages of 5 to 6 in the early primary regular education classes. This study documented significant pretest to posttest gains for three of the four subscales (Classification, Auditory Memory and Pattern Completion). Despite the older children, there were no ceiling effects for any of the subscales, with means and standard deviations well below maximum scores of pretests and posttests. Levy (as cited in Haywood and Lidz, 2007) also looked at the differences in mean performance on pretests and posttests of the ACFS subscales and total scores between the special needs and typically developing groups. The results showed that there were significant differences between pretest means for only the auditory memory, pattern completion and total scores, whereas the posttest results showed significant differences in means for four of the six subscales and the total score. The posttest scores showed a stronger discrimination between the groups. The visual memory subscale depicted a significant difference between the groups, implies that it is a

strong source of discrimination between the groups of children with and without developmental delays.

In summary, ACFS has been usefully employed in taking measures cognitive processes and learning strategies that are associated with typical early childhood learning activities.

3.6.4 Rationale for the choice of ACFS Classification subscale for this study :

Classification is one of the units of Bright Start Cognitive Curriculum and ACFS classification subscale measures the cognitive skills which are tapped in tasks involving classification. Therefore, it is an appropriate tool to evaluate children's learning from the Bright Start cognitive curriculum. In this research study, ACFS classification subscale was administered in a static manner for reasons which have already stated earlier.

Secondly, ACFS was selected because it shares a similar theoretical framework as the Bright Start Cognitive Curriculum is grounded in the works of Vygotsky, Feuerstein's mediated learning experience and Haywood's transactional perspective on human abilities. ACFS is a curriculum based assessment that provides a means of relating assessment to instruction and intervention (Haywood and Lidz, 2007). It is designed to assess cognitive functions and the metacognitive processes the child uses to solve a problem or complete a task rather than the child's intelligence. From the observed applications (performances), inferences are made regarding the child's cognitive functions (Haywood and Lidz, 2007). The ACFS classification subscale is appropriate as an instrument in this study because it is relatively easy to administer and more importantly, it directly relates to Bright Start cognitive curriculum's objectives of enabling the child to classify objects in different ways through the dimensions of colour, size and shape, and this leads to representational classification.

Since classification is a basic cognitive process in a pre-operational child and it was prominent even in the integrated thematic curriculum for the children in the control group of the research study; therefore, the ACFS classification subscale is an appropriate measurement and there was no unfair comparison when looking at the control group's performance at the post test.

3.6.5 Procedures for administering the ACFS Classification subscale

The classification subscale was administered with individual children for a period of 15 to 20 min. The child was given a set of wooden blocks and asked what he/she could do with the blocks. The investigator observed if the child deliberately manipulates or organises pieces into a building or structure. Next, the child was asked to group the blocks and state the basis for grouping the blocks. Once the child has grouped according to one attribute, the child was asked if there were other ways of grouping the blocks and to state the basis for the re-grouping. See Appendix F for procedures for administering the ACFS classification subscale.

Scoring :

ACFS uses raw scores and calculations of percent of items correct. Since the investigator was using the ACFS subscale as a static assessment, only the raw score calculations were applicable. Accomplishment of each step within a task earns 1 point. The scores for the completed tasks were summed up for pretest and subsequently for post test. Both the scores were recorded (See Appendix F for the scoring for ACFS subscale).

3.6.6 Description of Raven's Coloured Progressive Matrices (RCPM)

RCPM is a norm-referenced test used as a static assessment for assessing reasoning ability which requires making comparisons, perception, and organisation of space, analytical perception of visual stimuli, and analogical thinking. "From its inception, it has been acknowledged that RCPM has a high "g" loading with visuo-spatial "k" factor involved in some degree. The test is not a measure of "general intelligence", but it does measure a person's intellectual output in a pure factorial sense." (Raven,

Raven & Court, 1998. p. 29). RCPM is related to Piagetian conservation concepts where the reasoning process from perceptual to conceptual is required for RCPM solutions (Raven, Raven & Court, 1998). Further development of this work in the USA and Germany has led to the conclusion that three types of items can be identified within the RCPM and that is abstract reasoning by analogy, pattern completion through identity and closure and simple pattern completion (Raven, Raven & Court, 1998).

3.6.7 The use of Ravens's Coloured Progressive Matrices (RCPM) in previous studies of Bright Start Cognitive Curriculum

Ravens's Coloured Progressive Matrices (RCPM) has been used in several Bright Start Cognitive Curriculum studies (Paour, Cebe, Lagarrigue & Luiu, 1993; Cebe & Paour, 2000; Tzuriel, Kaniel, Kanner & Haywood, 1999) to assess the effects of the programme on the children.

In a study conducted by Paour, Cebe, Lagarrigue & Luiu (1993), RCPM was used to assess individual differences in intelligence. The children who had Bright Start cognitive curriculum attained significantly higher scores in RCPM than the children in the control group. Cebe and Paour (2000), replicated the study with another group of children in another part of the country. When compared on RCPM in kindergarten as well as first to third grades, the low SES immigrant children who participated in Bright Start during kindergarten scored significantly higher than the two control groups (low SES immigrant and high SES non immigrant) at first and second grades and significantly higher than the low SES immigrant group at the third grades.

Tzuriel, Kaniel, Kanner & Haywood (1999) compared low SES children who had received the Bright Start cognitive curriculum with those who had attended a programme of basic school readiness skills. RCPM together with other static tests and dynamic assessment tests were given as pretest and posttest. When compared on RCPM, the children from the Bright Start cognitive curriculum showed

significant improvement from pre to post intervention than the children from the comparison group.

3.6.8 Rationale for the choice of RCPM for this study

The rationale for the choice of RCPM for this study is as follows.

Firstly, RCPM is a norm-referenced test with evidence of validity of the constructs in Piagetian conservation concepts of reasoning process from perceptual to conceptual and analogical thinking (Raven, Raven & Court, 1998). There is also the reliability of the test scores when tested in different cultural contexts, at different times and by different examiners.

Secondly, RCPM is developmentally appropriate for preschool children and it assesses the child's conservation concepts which are required for RCPM solutions. This corresponds to the objectives of the Bright Start Cognitive Curriculum to develop conservation and number concepts.

Thirdly, RCPM assessment also relates to the objectives of the Bright Start Cognitive Curriculum in developing basic cognitive functions of logical reasoning which require a host of other skills such as comparison, perception and analogical thinking.

Finally, it has been used in previous studies of Bright Start Cognitive Curriculum and RCPM has successfully demonstrated the effects of Bright Start programme on the learning outcomes of the young children (Paour, Cebe, Lagarrigue & Luiu, 1993; Cebe and Paour, 2000; Tzuriel, Kaniel, Kanner & Haywood, 1999).

3.6.9 Procedures for administering RCPM for pretest and posttest

RCPM was administered with each child for about 20 min. The child was asked to look at the top figure on the page with a piece cut out of it. The child was required to select one of the six options found at the bottom of the page that would complete the pattern of the figure. The child proceeded to complete the entire booklet from

A1 to B12 with a total of 36 items. The test was administered statically where the assessor was not allowed to assist the child to derive the correct answer. See Appendix G for greater details on the procedures and scoring of RCPM.

3.6.10 Video Recordings of Children's Response to Classroom Teaching

Video recordings of teaching sessions provide a rich source of information, and enable the investigator to obtain a more holistic impression of teaching and learning that takes place in the natural classroom setting. "Videos show both teacher's and student's actions and thus can be viewed from both the teacher's and student's perspectives allowing attention to both teaching and learning issues" (Brophy, 2004, p. 299). In the context of research, the data collected from videos can be further examined from different perspectives (Brophy, 2004; Stigler and Hiebert, 1999). The video recordings provided information on children and teacher interaction, how questions were posed, how questions were answered and gave further insights into the research questions. Through the video recordings, observations were made of children's application of cognitive functions in different areas of learning, thus yielding some evidence of whether the cognitive functions have been acquired or enhanced.

3.6.11 Procedure :

Approximately 8 to 10 teaching sessions of each of the experimental and control teachers were recorded on videos throughout the duration of the study from May to October 2008, with the investigator as the non participant observer and recorder. Each video recording of the entire teaching session was approximately 30 to 45 min in length.

3.7 Programme effects on academic achievement

Question : 2) What are the programme's effects on the achievement of preschool children in the academic domain ?

3.7.1 Measures used in the collection of data on academic achievement

The measurements used in the collection of data on academic achievement were the academic/cognitive domain assessment of the standardised Brigance Diagnostic Inventory of Early Development II (IED-II) (Brigance, 2008) and a criterion reference measure on reading assessment at the preprimer level and basic mathematics from the same inventory, known as Brigance 2 in this research study.

3.7.2 Description of Brigance Diagnostic Inventory of Early Development II (IED –II)

The Brigance Diagnostic Inventory of Early Development II has been standardised and validated for children from birth to seven years of age. It is widely used for diagnostic as well as for determining readiness for school. This includes tracking developmental progress, providing a range of scores needed for documenting eligibility for special education services, comparing children's skills within and across developmental domains in order to view strengths and weaknesses, determining entry points for instruction and assisting with programme evaluation (Glascoe, 2004). The skills being assessed are derived from 6 developmental domains : fine motor skills, gross motor skills, receptive and expressive language, academic/ cognitive, daily living and social emotional.

3.7.3 The use of Brigance Diagnostic Inventory of Early Development (IED-II) in studies of preschool children.

Internal consistency that relate to the developmental domains of motor skills, social-emotional, language, academic/cognitive and daily living, was established in 1991 via a large standardization study of 1156 children from 12 months to 7 years of age from the U.S population. Coefficient alpha was produced for each task of the IED. The internal consistency ranged from .85 to .99. There was also evidence of test and retest reliability that ranged from .82 to 1.00, when the 1156 children were tested twice. The inter-rater reliability ranged from .82 to .96. Hence Brigance (IED-II) is a highly reliable tool with high degree of internal consistency, test and retest reliability and inter-rater reliability (Glascoe, 2004).

The IED-II is considered to have strong content validity. Items selected by a pool of educators and psychologists were drawn from research and other measures. The IED-II also demonstrates desirable age related trends where younger children have lower scores than do older children administered the same subtests. IED-II has very good concurrent validity where the domains, subdomains and subtests are highly correlated with diagnostic measures of development, academic performance, and intelligence and teacher/examiner rating. IED-II has a high degree of discriminant validity where children with and without disabilities and risk factors for developmental problems including prematurity, score significantly differently on this measure. IED-II is considered to be non discriminatory with regards to ethnicity but is responsive to known psychosocial risk factors including parental level of education and poverty. IED-II predictive validity showed strong and high correlations six months to two years later with criterion measures of intelligence, academic achievement , family environment, language development and teacher ratings (Glascoe, 2004).

In a study by Mantzicopoulos (2000), Brigance was used in the early detection of Head Start children with possible cognitive/academic giftedness. The data was collected from a sample of 134 children and 13 of whom were identified as potentially gifted based on their performance on the Kaufman Assessment Battery for Children (K-ABC). Similar to results of K-ABC, the potentially gifted children performed significantly better on the Brigance than the non-gifted children. The results of this study provided support for the use of Brigance in the early identification of economically disadvantaged children with possible cognitive/academic giftedness.

Unruh and Dupree (1998) used IED to evaluate the effects of Feuerstein Instrumental Enrichment (IE) with 4 to 5 year old children who were diagnosed with receptive and expressive language disabilities. The IED was used during pre and post test and the results indicated that the children's scores showed significant gains from pre to post test performance on all three subtests (i.e., general

knowledge, receptive language and expressive language). These results were consistent with the children's performance on the Vineland Adaptive Behaviour Scales.

3.7.4 Rationale for the choice of Brigance Diagnostic Inventory of Early Development (IED-II) for my study.

The skills being assessed in Brigance (IED-II) are derived from 6 developmental domains. However, for the purpose of my study, only the academic/cognitive domain was used to collect data on children's academic progress (see Appendix B).

Brigance IED-II academic/cognitive domain yields information on children's basic numeracy and literacy skills which are foundational to their academic progress and performance. In the academic/cognitive domain, the following sub areas are covered:

Table 3.4

Subdomains of academic/ cognitive domain

Quantitative	Pre-reading and reading
Number concepts	Visual discrimination
Rote counting	Rote recitation of alphabets
Money	Lower case letter knowledge
Numerical comprehension	Sounds of lower case letters
Ordinal position	Auditory discrimination
Colour knowledge	Survival sight words
	Basic preprimer vocabulary

The investigator has included an additional criterion reference measure from the IED-II on reading assessment at the preprimer level and mathematical skills that were relevant to the children in local context, where the standard was higher compared with other countries. The reading passage contained 33 words from the

Harris-Jacobson (1974) word list. For mathematics, the criterion reference measures included write following and preceding numerals, rote count backwards within the range of 20, read number words and identify numerals within the range of 100 from the IED-II. The above criterion measures, known as Brigance 2 in this study, were used to collect data on the academic progress of the children in the study.

3.7.5 Procedures for administering IED-II :

For administering the standardised assessment in the academic/cognitive domain of IED-II, the investigator followed the instructions stated in the examiner's book (see Appendix H for procedures for administering academic/cognitive domain of Brigance IED-II). For assessing the additional criterion referenced measures in reading and mathematical skills from IED-II, each child was asked to read the pre-primer passage which consists of 33 words from the Harris Jacobson (1974) word list and complete the mathematical tasks of writing following and preceding numerals, rote count backwards within the range of 20, reads number words and identify numerals within the range of 100 (see Appendix C) for a copy of the additional criterion referenced measures in reading and math skills.

3.8 Teacher-child interaction

- 3) What are the effects of the Bright Start teachers' use of mediated learning teaching styles on the development of children's cognitive functions ?
- 4) To what extent do the observed teachers' interactions with the children fulfill the 3 essential criteria of mediated learning experience ?

3.8.1 Measures used for data collection on teacher-child interactions.

The instruments used in the collection of data for the above questions were the Guidelines for Observing Teaching Interaction (Lidz, 2003)(see Appendix I), and the Children's Response to Mediation Scale (Lidz, 2003) (see Appendix J). Video data was used to analyze for presence of or absence of the components of MLE in

the Guidelines. The Children's Responses to Mediation Scale was used by the experimental teachers to evaluate the children's response to mediation.

3.8.2 Description of the Guidelines for Observing Teaching Interaction

During the implementation of the Bright Start programme and the regular integrated thematic curriculum, Guidelines for Observing Teaching Interaction (Lidz, 2003) were used to record observations of the teachers in the experimental and control groups. The Guidelines for Observing Teaching Interactions reflect the 12 components of adult-child MLE interactions that is supposed to promote the development of 'higher mental functioning'. These components are as follows (see Appendix N for an explanation for each MLE component) :

- intent, meaning,
- transcendence,
- joint regard,
- shared experience,
- task regulation,
- praise/encouragement,
- challenge,
- change,
- differentiation,
- contingent responsivity and
- affective involvement.

Each component is made up of different descriptive items rated from 1 (not evident) to 4 (evident at high level).

There have been several studies involving the Mediated Learning Experience Rating Scale (MLERS) and summary of the findings are discussed in the subsequent paragraphs. There are no known published studies conducted using the Guidelines for Observing Teaching Interaction but according to Lidz (2003), teachers are also primary mediators of children's development; hence the

Guidelines for Observing Teaching Interaction capture the same MLE components within the formal, more group-oriented interactions in educational settings. In another words, the components of the two scales; ie MLERS and Guidelines for Observing Teaching Interactions, are very similar.

Klein (1988) has developed a similar instrument, The Observation of Mediation Instrument (OMI), which measures the five MLE criteria: Intentionality and reciprocity, transcendence, communication of meaning, mediation of a feeling of competence, and regulation of behaviour. The OMI was developed for use with mothers and infants and hence, it is not suitable for teachers and 5 to 6 year old children in group settings in the classrooms in my research study.

3.8.3 The use of the MLERS in studies of adult-child interaction.

The MLERS has been used in several studies of adult-child interaction. In 1986, Glazier (as cited in Lidz, 2003) included 24 African American mothers of 4 year old Head Start children with low-normal IQ scores and above average preschool achievement scores. Glazier found the inter-rater agreement for the components range from 50% to 75% for exact agreement. Internal consistency as determined by Cronbach's alpha was 0.83. The mothers in this study received their highest ratings on the components of intent and lowest ratings on the components of transcendence, praise/encouragement and meaning. The presence of transcendence, praise/encouragement and meaning were the greatest differentiation between the mothers who have high total ratings and mothers who have low total ratings. Multiple regression showed that IQ plus MLE (mediated learning experience) together explained more of the achievement variance than either IQ or MLE considered on its own.

Lidz, Bond and Dissinger (1990) investigated the cross-cultural situational consistency of the MLERS with well-educated Caucasian mothers of normally developing preschool children. These mothers, in contrast to the mothers of low socioeconomic status, received high ratings on the components of transcendence

and praise/encouragement, as well as on the component of sharing. The consistency of the mothers' mediation was variable across the three situations of two structured teaching and one free play. However, for the components of sharing, praise/encouragement, contingent responsivity, and affective involvement were least affected by nature of the task. The components were also correlated with the perceptual-performance subtest score of the McCarthy Scales. The children of mothers who received high ratings on transcendence, obtained the highest scores on the perceptual performance subtest score of McCarthy Scales of Children's Abilities. This result yielded a significant positive relationship with transcendence.

A study by Zambrana-Ortiz and Lidz (1995) included 26 dyads of both mothers and fathers (i.e., 26 children interacting at separate times with their mother and father) in both teaching and playing situations. These were normally developing three to five year olds enrolled in Head Start in Puerto Rico. For both parents' combined scores, ratings on the components of intent and affective involvement were high, whereas ratings on the components of transcendence and praise/encouragement were low. This study also investigated the criterion validity of the MLERS in relation to the HOME (Home Observation for Measurement of the Environment) by Bradley & Caldwell (1984, as cited in Zambrana-Ortiz and Lidz, 1995). The HOME is a 55-item rating scale, with information based on observation or responses to questions by parents of children between the ages of three to six years. The scale was completed during, and directly following, a visit of about one hour to the child's home. Areas assessed by HOME include: acceptance, learning stimulation, language, language stimulation, warmth and affection, physical environment, academic stimulation, modeling and a variety of experiences. The findings from the study provided some support for the concurrent validity of the MLERS, but they also suggested that these instruments were measuring different variables; such as social and demographic variables, i.e., income and education, of fathers and mothers. Fathers who were more educated and with higher income scored better on the MLE scale. Mothers who were more educated, with fewer children and with husbands who were more educated rated higher on MLE scale.

Another study by Weinblatt (1993, as cited in Lidz, 2003) rated 32 mothers during the course of play interactions with their 3 to 4 year old children with mild to moderate disabilities. The ranges of education and income levels of mothers were wide, with most being single or working parents. The types of children's handicaps included speech impairment, emotional disturbance, mental retardation, learning disability and autism. This study focused on furthering understanding of mediational interactions between mothers and their children with handicaps and the relationship between their mediations and the development of competence in the children. The mothers were observed in five conditions of interaction, and there was highly significant consistency in the mediation ratings in the five situations, varying from 0.62 to 0.86. The components of sharing and change were rarely observed in these interactions. This study documented a significant positive relationship between the mothers' MLE and their children's success in solving the tasks of the study. The MLE components that showed the strongest relationship with the children's success were task regulation, praise/encouragement, challenge, psychological differentiation and contingent responsivity. There were also significant but more moderate, correlations between the mothers' mediation ratings and their children's IQ. There was also a significant correlation between IQ and the child's reciprocity. Hence, mothers were more mediational with children who were more responsive and who had higher IQ scores. In the multiple regression, child's reciprocity was the strongest predictor of the child's task performance, followed by MLE components of task regulation, challenge and contingent responsivity.

These studies generally have provided strong support for the reliability and validity of MLERS for assessing adult-child interactions that affect children's development. The MLE components in the MLERS are the same as those found in the Guidelines for Observing Teaching Interaction.

3.8.4 Rationale for the choice of Guidelines for Observing Teaching Interactions for this study

The rationale for the choice of Guidelines for Observing Teaching Interactions for this study is as follows. Firstly, the Guidelines for Observing Teaching Interactions reflect the components that qualify interactions as MLE. To the best knowledge of the investigator, it is the only rating scale that has successfully captured the same MLE components within the formal, more group-oriented interactions in educational settings. There are also numerous studies cited earlier that have provided strong support for the reliability and validity of MLERS where the MLE components are the same as those found in the Guidelines for Observing Teaching Interaction.

3.8.5 Procedure for administering Guidelines for Observing Teaching Interactions for teachers from the experimental and control groups.

With reference to the Guidelines for Observing Teaching Interactions, video data was analysed for the presence of the components of MLE. Each teacher from each group, experimental and control was rated for the occurrence of the items (see Appendix I) from the scale of 0 to 4 on for each entire lesson. A second person, who did not know whether the teachers belonged to the experimental or control groups, was asked to observe 50% of the teaching video sessions and rate the occurrence of the items. The standard for inter-rater agreement has been established at 90% (Fraenkel & Wallen, 2006).

3.8.6 The Response to Mediation Scale

The Response to Mediation scale is appropriate for observing and evaluating the reciprocal processes that occur during mediated learning teaching approach in terms of children's responses. In fact, some of the sub scales of the instrument are counterparts in the MLERS (Van der Aalsvoort and Lidz, 2002), such as 'response to challenge' in Response to Mediation which elicits competency by 'creating a challenging zone' in the MLERS, and 'self regulation' in Response to Mediation which elicits competence by 'task regulation' in the MLERS. Other subscales are specific to child characteristics such as Responsiveness to interaction, and Communication. The Response to Mediation has 11 subscales and each subscale

comprises of five-point rating scales from poor (1) to high (5). The MLE rating scale and responsiveness scales have characteristics that clarify the reciprocal processes during tasks in classroom setting and it has been established that the internal consistency of the combination of these subscales expressed as Alpha was high ($\text{Alpha} = 0.91$) (Van der Aalsvoort and Lidz, 2002).

3.8.7 The use of Response to Mediation Scale in the studies of preschool children.

The Response to Mediation Scale was used in studies by Van der Aalsvoort & Lidz (2002 and 2007). In the 2002 study conducted with a group of 78 intellectually impaired students, with age ranges from 60 months to 79 months, the results showed that there was a positive relationship between mediation and response to mediation. Overall, the results of this study supported reciprocity during an intervention, as a critical dimension in the process of mediation.

In Van der Aalsvoort & Lidz (2007) study, a total of 89 participants, from six regular primary schools in Netherlands participated in a study on Application of Cognitive Function Scale (ACFS), a curriculum-based dynamic assessment for use with young children. The mean age for the male participants was 67 months and mean age for the female participants was 66 months. Response to mediation scale was one of the instruments used in addition to the ACFS subscales of visual memory, sequential pattern completion, auditory memory and classification. The results indicated there was a significant relationship between the response to mediation and the assessment of auditory memory subscale. This finding suggested that the more responsive the students were to mediation, the better they performed on the scale that measured ability to use memory related to auditory modality. However, the relationship between response to mediation and the other ACFS subscales were not apparent on other ACFS subscales, and the authors suggested this could be an issue of ceiling effects.

In summary, the response to mediation scale provides insights into students' learning behaviours and studies suggested that the more responsive the students were to mediation, the better they performed on tasks that assessed their learning.

3.8.8 Rationale for the choice of the Response to Mediation Scale for this study

The rationale for the choice of the Children's Responses to Mediation Scale for this study is as follows. Firstly, data from the children's response to mediation scale provide more information on the children's acquisition of cognitive functions from the teacher's perspective. Secondly, some of the sub scales of the children's response to mediation scale are counterparts of the MLE rating scale and Guidelines for Observing Teaching Interactions. Finally, children's Response to Mediation Scale was used in previous research studies with children from five years old onwards, and this is the same age group as the children in this research study.

3.8.9 Procedures for administering the Response to Mediation Scale:

Teachers from the experimental group completed a response to mediation scale for each child on a weekly basis. The purpose was to observe how the children respond to mediation by the experimental teachers who were trained in MLE. The teachers from the control group were not trained in MLE and hence, they did not consciously mediate according to the essential components of MLE (Feuerstein et al., 1980; 2006). As such the Response to Mediation was not appropriate for the children from the control group. (See Appendix J for the Response to Mediation Scale).

3.9 Summary :

In this chapter, detailed information on the participants of the study, the context of the study, the chosen measurements and rationale for their uses in the research study and the processes of implementation of the intervention programme have been provided. The next chapter presents the findings of the study obtained with the methods presented.

CHAPTER 4

RESEARCH FINDINGS

Introduction

The methods of data analysis and results of the study are presented in this chapter. The study reported here examined in detail the effects of the Bright Start Cognitive Curriculum, as compared with the regular integrated thematic curriculum, in enhancing children's cognitive functions to facilitate their achievement in the academic domain. This chapter is organised according to the research questions, followed by the methods of data analysis and presentation of the results.

4.1 Examining main and interaction effects

Research questions :

- 1) Which cognitive functions, if any, have been enhanced by the Bright Start Cognitive Curriculum ?
- 2) What are the programme's effects on academic achievement of preschool children in the academic domain ?

4.1.1 Methods of data analysis :

The tests for addressing question 1 and 2 are Application of Cognitive Function Scale (ACFS) classification subscale, norm-referenced Raven's Coloured Progressive Matrices (RCPM) Brigance Diagnostic Inventory of Early Development II (IED-II) standardised academic/cognitive domain assessment and Brigance Diagnostic Inventory of Early Development (IED-II) criterion referenced assessment

To answer the above research questions, an analysis was conducted using a series of tests/measures that examine the responses of the participants in both the experimental and control groups. The design of the study used a 2 x 2 ANOVA with the treatment as a between-subject factor (Experimental vs. Control group) and pre-post tests (time element) as the within-subject factor. ANOVA is preferred over t-

tests because it is a repeated measure to detect the main and interaction effects between the factors over time, therefore to test more complex hypotheses about reality. While t-test compares only the means of two groups, ANOVA examines two factors simultaneously; in this research study, the two factors were between-subject factor (experimental vs. control) and within-subject factor (time element in pre-post tests). The effect of each of the above factor as well as interaction effect of the two factors were examined.

Effect size was used to report the significance of the difference between the experimental and control groups. According to Coe (2002), one of the main problems associated with the use of p-value is that it depends on the size of the effect and the size of the sample. But most important of all, statistical significance does not tell the size of the effect. The use of effect size is particularly valuable in quantifying the effectiveness of this particular intervention (Coe, 2002). This is also consistent with the encouragement of this approach given by the American Psychological Association to report effect size in research studies (Wilkinson et al., 1999).

There are many ways of calculating effect sizes. For this research study, the Hedges g effect size, with its adjustment for sample size, was used to quantify the size of the difference between the experimental and control groups (Coe, 2002).

The labeling used to name the dependent variables in this study are listed in Table 4.1.

Table 4.1: The variables

Variable Name	Variable label/Value Label
Group	The group participants are in; either in the experimental group (eg) or control group (cg)
RCPMpre	RCPM, pre test
RCPMpost	RCPM, post test

ACFSpre	ACFS, pre test
ACFSpost	ACFS, post test
Brigancepre	Brigance, pre test
Brigancepost	Brigance, post test
Brig2pre	Brig2, pre test
Brig2post	Brig2, post test

To answer the two primary questions listed above, initial comparisons have to be made between the mean and standard deviation in relation to each of the test (subscale) as a source of information with regards to the relevance of this procedure for this population.

To investigate if there were significant differences across these subscales and time, the SPSS General Linear Model (GLM); Repeated Measures ANOVA was used. The assumptions of Repeated Measures ANOVA are similar to those for ANOVA in terms of normality and homogeneity of variances. However, in addition to the variances, which involve deviations from the mean of each person's rating on one subscale, the repeated measures design also takes into account of more than one measure of subscales for each person.

4.1.1.1Data Assumptions

We need to assume the relationships between pair of experimental conditions are similar (i.e. the level of dependence between pairs of groups is roughly equal). This assumption is more commonly known as sphericity. The null hypothesis test of the test of sphericity is: the variance-covariance structure has the Huynh-Feldt structure, so called Type H structure.

4.1.1.2Effects of meeting sphericity assumption

If the sphericity test is not significant then we cannot reject that null hypothesis that the variance-covariance structure has Type H structure.

4.1.1.3 Effects of violating sphericity assumption

If, however, the sphericity test is significant then we reject that the variance-covariance structure has a Type H structure. The effect of violating sphericity is a loss of power (i.e. increased probability of a Type II error) and a test statistic (F-ratio) that cannot be compared to tabulated values of the F-distribution (XXX). One will need to further investigate the severity of departure from the sphericity assumption; using SPSS Mauchly's test.

1. If Mauchly's test is significant ($p < 0.05$), we can infer that there are significant differences between the variance of differences: the condition of sphericity is not met. We cannot trust the F-ratios produced by SPSS.
2. If Mauchly's test is not significant ($p > 0.05$), it is reasonable to infer variance of differences are roughly equal; condition of sphericity is met.

4.1.1.4 Corrections for violation of sphericity assumption

There are several corrections that can be applied using SPSS to produce a valid F-ratio. All of these corrections involve adjusting the degree of freedom associated with the F-value. In all cases, the degree of freedom is reduced based on an estimate on how spherical the data are; by reducing the degree of freedom to make the F-ratio more conservative. There are three different estimates of sphericity used to correct the degree of freedom in SPSS

- Greenhouse and Geisser's (1958)
- Huynh and Feldt's (1976)
- The lower bound estimate

Which one to use?

1. When estimates of sphericity (ϵ) >0.75 , then use Huynh and Feldt's
2. When estimates of sphericity (ϵ) <0.75 , then use Greenhouse and Geisser's correction

For this research study, the F value or degree of freedom has been adjusted with the use of Greenhouse and Geisser (1958) because there were several violations in relation to the co-variances for the main dependent variables for the experimental and control groups. Please see Appendix O for the detailed output of the data.

4.1.2 Results: Cognitive functions and programme effects

The tests for addressing question 1 and 2 are Application of Cognitive Function Scale (ACFS) classification subscale, norm-referenced Raven's Coloured Progressive Matrices (RCPM) and Brigance Diagnostic Inventory of Early Development II (IED-II) standardised academic/cognitive domain assessment and Brigance Diagnostic Inventory of Early Development (IED-II) criterion referenced assessment.

Comparison is made between the mean and standard deviation of the control and experimental group scores for each of the measures taken before and after the study. Mean scores are recorded for each test in each group. Standard deviations are given in parentheses. Each of the four different tests is presented separately in the following pages.

4.1.2.1 RCPM (Raven's Coloured Progressive Matrices)

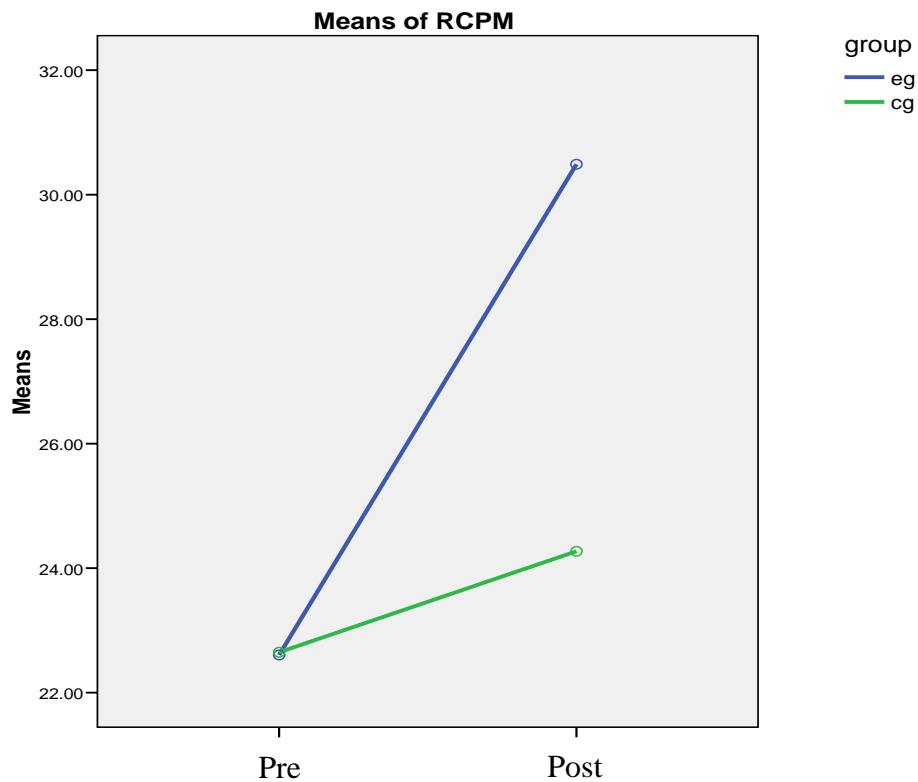
The scores from RCPM are presented in a means and standard deviation table, followed by a figure and description of the findings.

Table 4.2

Means and standard deviations for RCPM for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).

RCPM	Pre-test & Post-test	Mean
Experimental n=43	Pre-test	22.60 (5.57)
	Post-test	30.49 (4.22)
Control n=37	Pre-test	22.65(5.77)
	Post-test	24.27 (7.05)

Figure 4.1 : RCPM for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).



The data in Table 4.2 shows that the mean score for the experimental group was higher than the control group and that the post-test scores were higher than the pre test. The factorial ANOVA confirmed that these differences in scores were

significant resulting in main effects for Time $F(1,78) = 139.72$, and Group $F(1,78) = 6.52$. Moreover, these main effects were qualified by significant interaction $F(1,78) = 60.6$ whereby the experimental group scores were significantly higher at post test as compared to the control group. This significant interaction supports the hypothesis that children's scores on the RCPM would improve due to the Bright Start Cognitive Curriculum. This is further supported by Hedges g effect size $= 1.08$, which is in the large range, see suggesting the effectiveness of the programme. See Table 4.6.

4.1.2.2 Application of Cognitive Function Scale (ACFS)

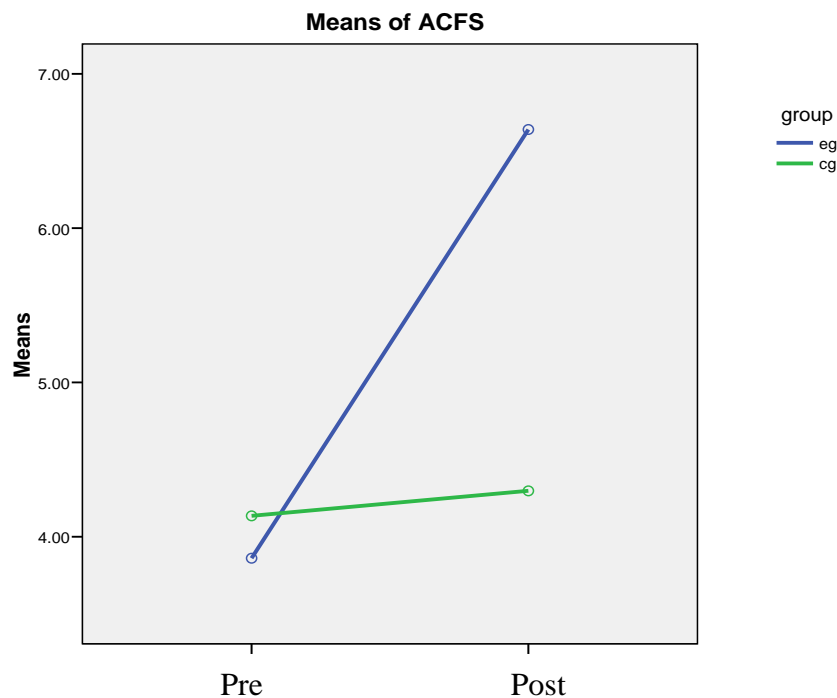
The scores from ACFS are presented in a means and standard deviations table, followed by a figure and description of the findings.

Table 4.3

Means and standard deviations for ACFS for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).

ACFS	Pre-test and Post-test	Mean
Experimental n=43	Pre-test	3.86 (2.75)
	Post-test	6.64 (2.08)
Control n=37	Pre-test	4.14 (2.69)
	Post-test	4.30 (2.90)

Figure 4.2 : ACFS for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).



The data in Table 4.3 shows that the mean score for the experimental group was higher than the control group and that the post-test scores were higher than the pre-test. The factorial ANOVA confirmed that these differences in scores were significant resulting in main effects for Time $F(1,78) = 26.83$, and Group $F(1,78) = 4.08$. Moreover, these main effects were qualified by significant interaction $F(1,78) = 21.24$ whereby the experimental group's scores were significantly higher at post test as compared to the control group. This significant interaction supports the hypothesis that children's scores on the ACFS would improve due to the Bright Start Cognitive Curriculum. This is further supported by Hedges g effect size $= 0.93$, which is in the large range, suggesting the effectiveness of the programme. See Table 4.6

4.1.2.3 Brigance

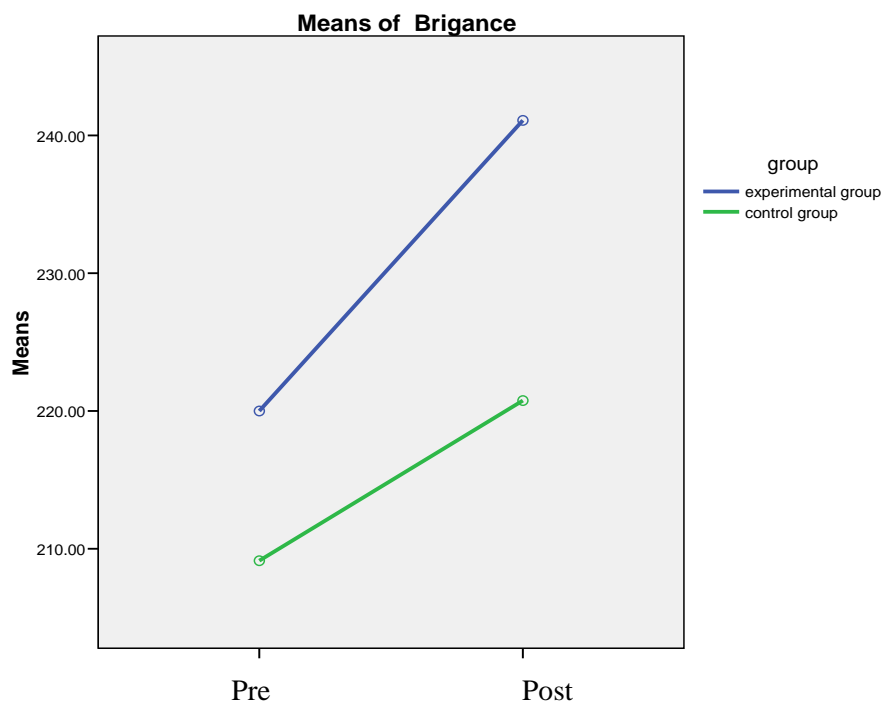
The scores from Brigance are presented in a means and standard deviations table, followed by a figure and description of the findings.

Table 4.4

Means and standard deviations for Brigance for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).

Brigance	Prepost	Mean
Experimental n=43	Pre-test	220.00 (17.73)
	Post-test	241.09 (11.79)
Control n=37	Pre-test	209.14 (27.39)
	Post-test	220.76 (27.76)

Figure 4.3 Brigance for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).



The data in Table 4.4 shows that the mean score for the experimental group was higher than the control group and that the post-test scores were higher than the pre-

test. The factorial ANOVA confirmed that these differences in scores were significant resulting in main effects for Time $F(1,78) = 160.4$, and Group $F(1,78) = 11.01$. Moreover, these main effects were qualified by significant interaction $F(1,78) = 13.45$, whereby the experimental group scores were significantly higher at post test as compared to the control group. This significant interaction again supports the hypothesis that children's scores on the Brigance would improve due to the Bright Start Cognitive Curriculum. This is further supported by Hedges g effect size $= 0.97$, which is in the large range, suggesting the effectiveness of the programme. See Table 4.6.

4.1.2.4 Brigance 2

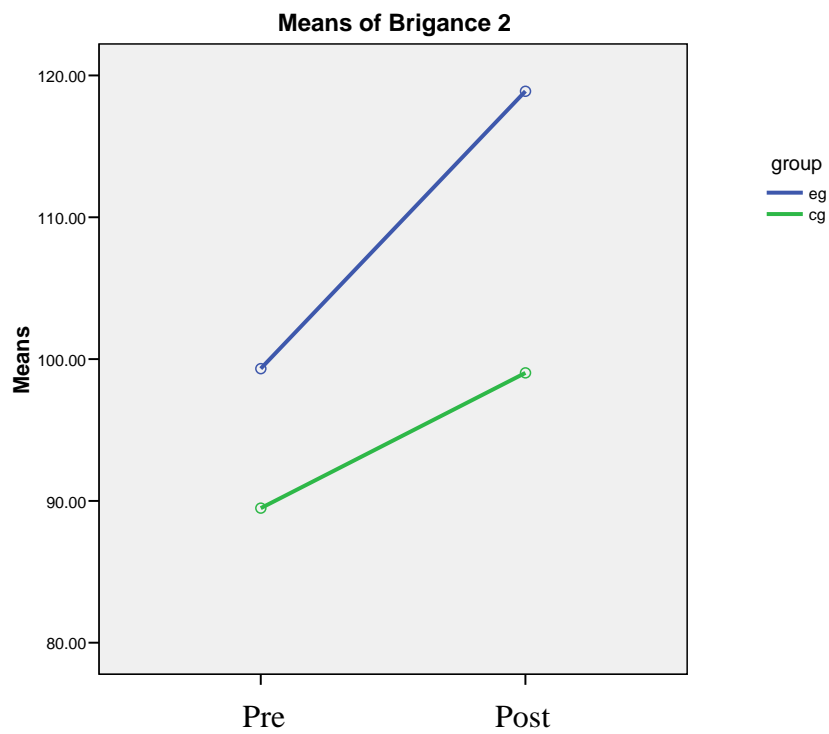
The scores from Brigance 2 are presented in a means and standard deviations table, followed by a figure and description of the findings.

Table 4.5

Means and standard deviations for Brigance 2 for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).

Brigance 2	Prepost	Mean
Experimental n=43	Pre-test	99.33 (24.52)
	Post-test	118.88 (12.86)
Control n=37	Pre-test	89.49 (31.51)
	Post-test	99.03 (27.82)

Figure 4.4 Brigance 2 for two-way ANOVA examining Group (Experimental v Control) x Time (Pre-test v Post-Test).



The data in Table 4.5 shows that the mean score for the experimental group was higher than the control group and that the post-test scores were higher than the pre-test. The factorial ANOVA confirmed that these differences in scores were significant resulting in main effects for Time $F(1,78) = 59.03$, and Group $F(1,78) = 8.08$. Moreover, these main effects were qualified by significant interaction $F(1,78) = 6.99$ whereby the experimental group's scores were significantly higher at post test as compared to the control group. This significant interaction supports the hypothesis that children's scores on the Brigance 2 would improve due to the Bright Start Cognitive Curriculum. This is further supported by Hedges g effect size $= 0.93$, which is in the large range, suggesting the effectiveness of the programme. See Table 4.6.

Table 4.6 Effect Size

Outcome measure	Experimental (n=43)		Control (n=37)		Effect size	
	Mean	SD	Mean	SD	Hedges g	Confidence interval
RCPM	30.49	4.22	24.27	7.05	1.08	(0.61-1.55)
ACFS	6.64	2.08	4.3	2.9	0.93	(0.47-1.39)
Brigance	241.09	11.79	220.76	27.76	0.97	(0.51-1.43)
Brigance 2	118.88	12.86	99.03	27.82	0.93	(0.47-1.39)

For each of the outcome measures, the size of the effect is large (Cohen, 1988) and the confidence interval indicates the findings are statistically as well as practically significant. Not only that, but the effect sizes are very similar across the different outcome measures indicating consistency and suggesting that the effect and the outcome measures were reliable.

In summary, the data of the four dependent measures consistently showed significant interactions in line with hypothesis that the changes in ability could be attributed to the Bright Start Cognitive Curriculum. All effect sizes were in the large range suggesting the effectiveness of the programme.

4.2 Children's responses during teaching

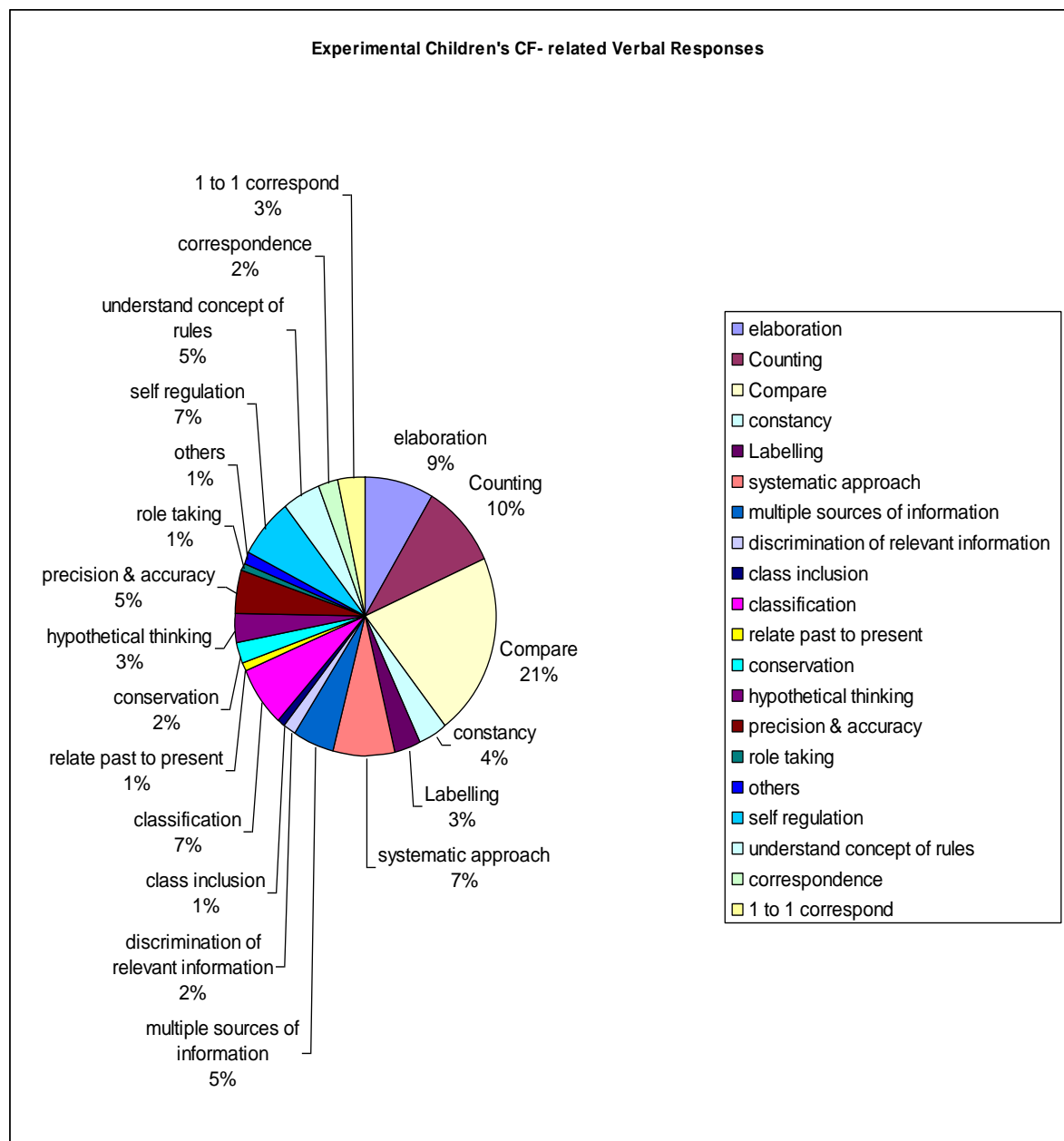
3) What are the effects of the Bright Start teachers' use of mediated learning teaching styles on the development of children's cognitive functions ?

4.2.1 Methods of data analysis

To investigate the above question, video recordings of teaching sessions of the experimental and control groups were used. For each group, video data was collected once a week during the period of the research study from May to October. There were a total of 8 to 10 video recordings of each group and each recording lasted from 30 to 45 min. For the method of data analysis, frequency counts were made of the cognitive functions manifested by the children during the interaction found in the form of verbal expressions of their thoughts. To ensure reliability of the procedure a second person was asked to do likewise. The degree of reliability is

expressed as the percentage of the total number of agreement that is the same for all observers (Call, Call & Borg, 2005). The standard for inter-rater agreement was aimed at 90% (Fraenkel & Wallen, 2006). Qualitative data analyses included documentation of children's verbatim cognitive function-related verbal expressions. The data obtained was compared across time from the beginning to the end of the study. The results are shown in the following pie charts.

Figure 4.5: Experimental Group Children's Cognitive Function-related Verbal Expressions



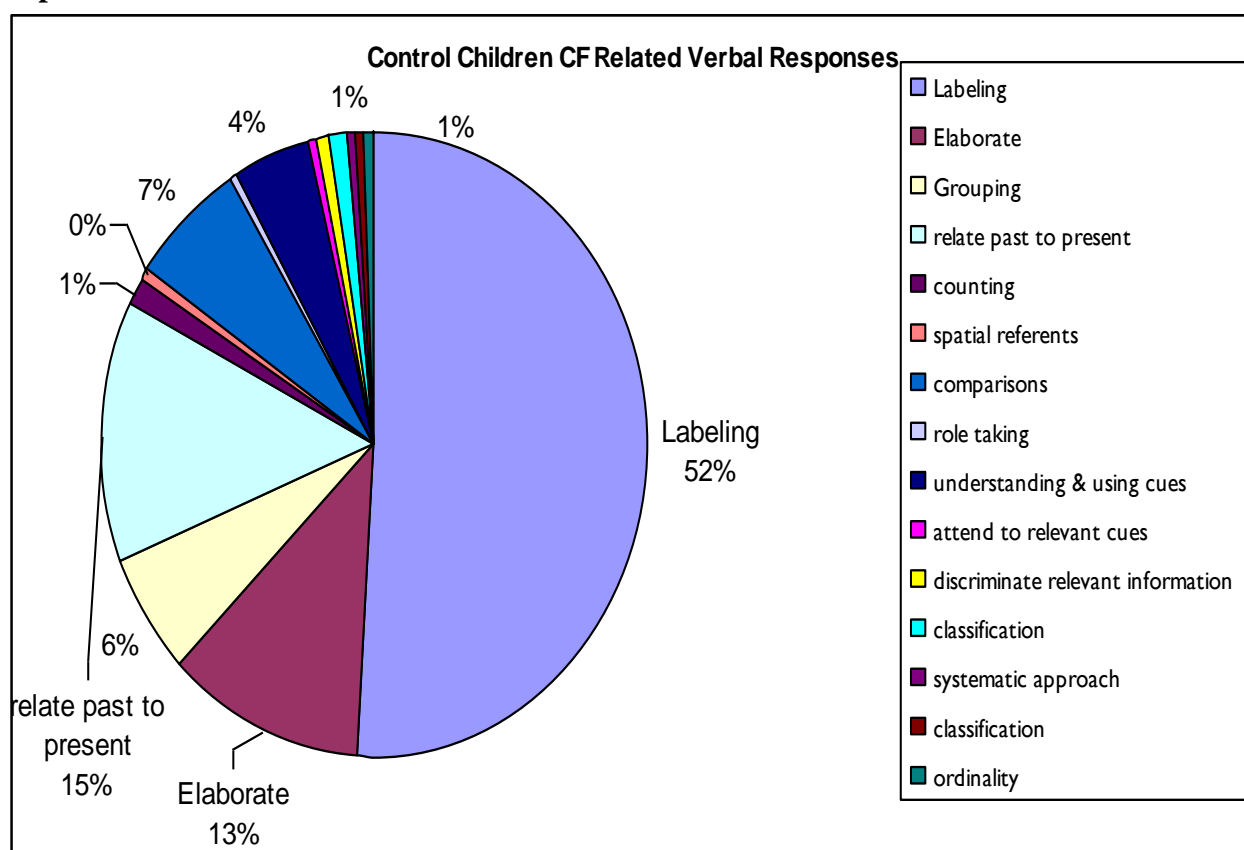
The following table provides examples of cognitive functions observed during verbal interaction between the children and their teachers in the experimental group.

Table 4.7 Examples of cognitive function-related verbal expressions in children from experimental group:

Examples	Cognitive Function
1) Child: "Rules help us to remember what to do." 2) Child: "Traffic rules help us not to bang into each other."	Understand concept of rules
3) Child: "You cannot run too fast, you need to see where you are going."	Self regulation
4) Child: "When I come to school, the first thing I do is to take my temperature, then the teacher will check my hands and mouth, then I will put my bag in the cubby hole."	Systematic approach
5) Child: "When I go to the market to buy a water bottle, it is \$8.00. So I count 2,2,2,2 (referring to \$2 note) and give to the man."	Counting
6) Teacher tilted a square and asked the class what is the shape. One child said it is a diamond shape. Another child responded: "Actually it is not a diamond, but still a square because you only turn it."	Constancy
7) Teacher: "Why do we need to use the words : 1 st , 2 nd , 3 rd ?" Child: "Because people don't know what you are saying, is it 1 st , 2 nd or 3 rd ?"	Precision and accuracy
8) Child: "we learn when you make the row (of counters) longer with bigger spacing (between the counters) or when you squeeze them (counters) together, the number is still the same because you did not take away any counter. Teacher: "How do you know there are the same number of counters when they look so different?" Child: "Because I count."	Conservation and counting
9) Teacher: "Are there other ways that you can group the children?" Child 1: "Those with long hair and those with short hair." Child 2: "Those with rubber band on their hair and those who don't have rubber band." Child 3: "Those with spectacles and those with no spectacles."	Grouping

10) Child: “ When my mommy buys t-shirt, she will compare the size and colour.”	Comparison on multiple dimensions
11) Teacher: “Why is it important for you to put things in groups ?” Child: “If you don’t group things, it is very messy and you cannot find your things.”	Elaboration
12) Teacher: “How can we group them (animals and insects) so that they become one big group ?” Child : “They are all living things.”	Class inclusion
13) Teacher: “Think of other times that you need to follow rules.” Child 1: “When I take the taxi, I need to queue up.” Child 2: “When I am riding the bus, I cannot eat.”	Multiple sources of information

Figure 4.6 Control Group Children’s Cognitive Function-related Verbal Expressions



The following table provides examples of cognitive function- related verbal interaction between the children and their teachers of the control group.

Table 4.8: Examples of cognitive function-related verbal expressions in children from control group

Examples	Cognitive Function
1) Teacher points to the cover of a picture book and asked: "What is this?" Child: "Butterfly." Child: "Ants." Child: "Mushrooms."	Labeling
2) Child: " Last time when I go for walk with my daddy, I saw a lot of trees and some mushrooms."	Relate past to present
3) Teacher: "If you see a mushroom on the ground, can you pluck and bring it home to eat ?" Child: "No, don't know if it is poisonous, some are poisonous."	Elaboration
4) Teacher showed children picture of a mushroom and asked: " Is this the same as plants ?" Child: "No, mushrooms have no leaves, plants have leaves."	Comparison
5) Teacher : "What is a submarine ?" Child " A vehicle."	Classification
6) Teacher: "Can you tell me what is a living thing ?" Child 1: "It can eat." Child 2: "It needs air." Child 3: "Need food and water." Child 4: "Can grow."	Discriminate relevant information
7) Teacher referred to the cover page of a picture book and asked: "How do you know it is raining?" Child: "Because drop, drop of water."	Understanding and using relevant cues

4.2.2 Results:

There was a higher number of cognitive function-related verbal expressions in the children from the experimental group as compared to children in the control group. In the experimental group, there were a total of 481 incidents of cognitive function-related verbal responses in 30 sessions with an average of 16.03 incidents in each

session. In the control group, there were a total of 204 incidents of cognitive function related verbal responses in 16 sessions with an average of 12.8 incidents in each session.

Not only was there a higher frequency of cognitive function-related conversations in the experimental group, results from Figure 4.5 appear to indicate that there was a range of higher and more complex level of cognitive functions related verbal responses; such as comparison (21%), self regulation(7%), classification (7%), elaboration(9%), counting (10%) and systematic approach (7%) in the experimental group. On the other hand, as shown in Figure 4.14, less complex and narrower range of cognitive functions such as labeling (52%), relate past to present (15%) and elaboration(13%) appear to characterise the verbal responses of the children from the control group. Examples of cognitive function-related responses from both groups of children are presented in Table 4.7 and 4.8.

The inter-rater reliability ranged from 0.73 to 1.00 with most exceeding 0.87 on the frequency count of major cognitive functions in each lesson.

4.3 Interaction between teachers and children

4) To what extent do the observed teachers interactions with the children fulfill the three essential criteria of mediated learning experience ?

4.3.1 Methods of data analysis

To investigate question 4, the guidelines for observing teaching interaction were used to observe teachers' interaction in both the experimental and control groups throughout the period of the research study. Mean scores were computed for the experimental and control teachers. In addition to this, the mean score of each component of MLE was also computed for the teachers from the both groups.

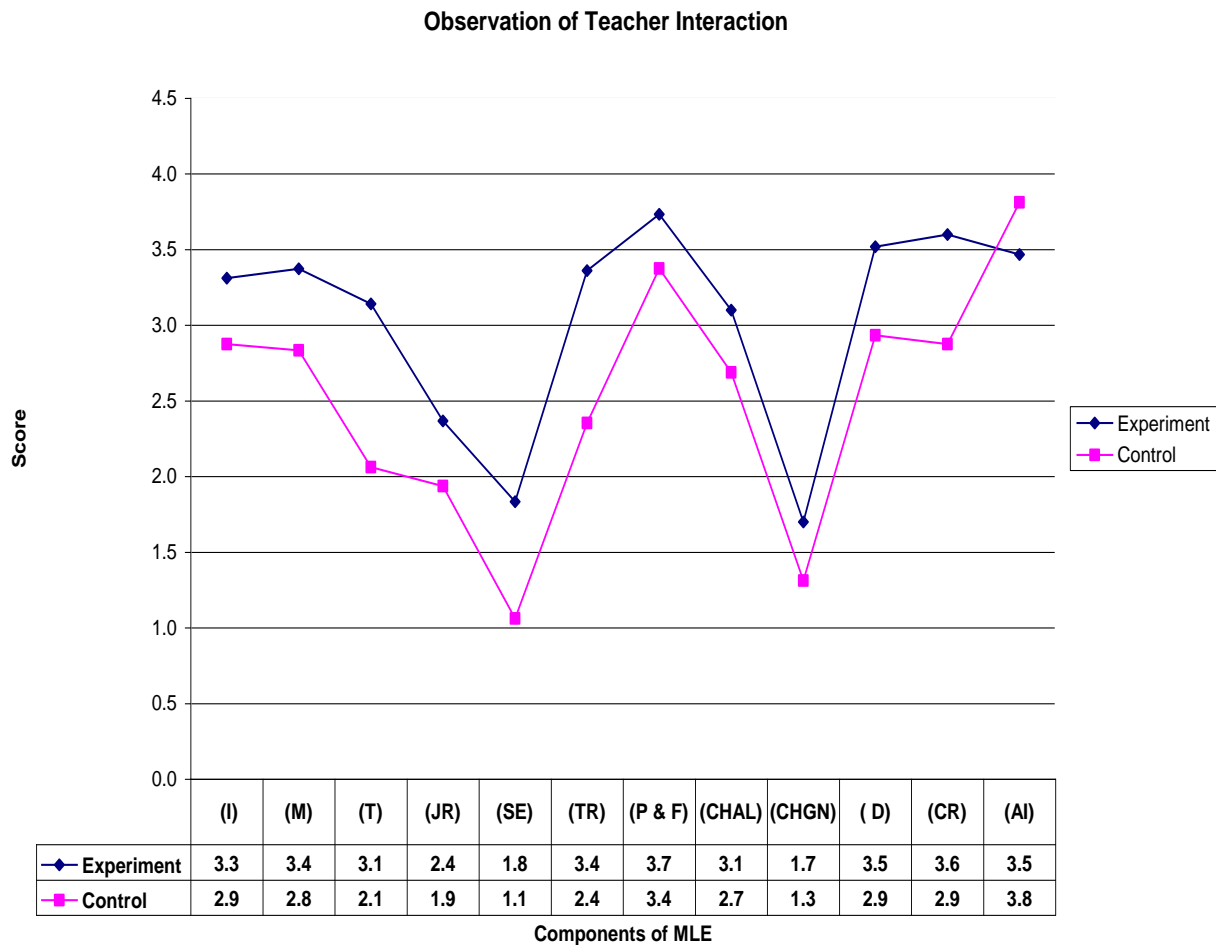
4.3.2 Results from Guidelines for Observing Teaching Interaction

Table 4.9 indicates that the experimental group had a mean score of 108.60 and a standard deviation of 9.26 whereas the control group had a mean score of 85.50 and a standard deviation of 8.39. From the scores, it appeared that there were significant differences between the experimental teachers and control teachers in their interactions with the children.

Table 4.9 Guidelines for Observing Teaching Interaction (GOTI)

Group	GOTI's Scores
Experimental n=3	108.60 (9.26)
Control n=2	85.50 (8.39)

Figure 4.7
Observation of Teacher Interaction



The components of MLE (mediated learning experience) are as follows :

I	Intentionality
M	Meaning
T	Transcendence
JR	Joint regulation
SE	Shared experience
TR	Task regulation
P & F	Praise and feedback
CHAL	Challenge
CHNG	Change
D	Differentiation
CR	Contingent responsivity
AI	Affective involvement

From the findings as shown in Figure 4.7, the experimental teachers scored higher in the three essential components of MLE; namely intentionality, meaning and transcendence and in all of the rest of the components of the MLE except the component on affective involvement where the control teachers scored higher than the experimental teachers. This appeared to indicate that the teachers from the experimental group were focusing on mediating the cognitive functions of young children and hence, the affective involvement appeared weak. This will be further discussed in the next chapter.

The inter-rater reliability ranged from 0.79 to 0.97 with most exceeding 0.85 on the observation of teacher interaction in both experimental and control groups.

4.4 Children's Response to Mediation Scale

The data obtained from children's responses to mediation scale were used to provide more information on the children's acquisition of cognitive functions from the teachers' perspectives.

The teachers' evaluation of children's responses to mediation was a good source of information to verify for consistency of scores between the scale and children's post test scores; in particular, whether there were evidence to suggest that the more responsive the children were to mediation, the better they performed on tasks that assessed their learning.

4.4.1 Methods of data analysis

The experimental group of 43 children was made up of three sub-groups of kindergarten children from three different childcare centres. Experimental sub-group one had 16 children; experimental sub-group two had 13 children and experimental sub-group three had 14 children. Pearson correlation was done for each group to examine the strength and direction of relationship between the two continuous variables (Punch, 2009); in this case, these two variables were children's response to mediation scores and post test scores.

4.4.2 Results on correlation between Children's Response to Mediation Scale and post test scores for Experimental group

Person correlation co-efficient, r , varies between -1 through +1. The closer numerically the coefficient to 1.00 (positive or negative), the stronger the relationship. The r value for experimental subgroup 1, $n=16$, was 0.803. The r value for experimental subgroup 2, $n=13$, was 0.499. The r value for experimental subgroup 3, $n=14$, was 0.747 (See Appendix O).

The findings showed that the two variables: children's response to mediation scores and post test scores were positively correlated. This suggested that the more responsive the students were to mediation, the better they performed on tasks that assessed their learning.

4.5 Reliability and validity of findings :

The post tests scores of the children from the experimental group reflected consistency in higher tests scores across all four tests. Findings were supported by the positive correlation between children who responded well to mediation and their post tests scores. Hence, all these pointed to the reliability of findings from the intervention. At the same time, the outcome measures of RCPM, ACFS, Brigance and Brigance 2, also reflected validity in measuring children's cognitive functions.

The small sample of the teachers who used the mediated learning experience yielded an interesting result. On the measure of affective involvement of teachers, interestingly, the experimental teachers obtained lower scores than the control teachers. The finding of this study and its interpretations are limited by its small sample size of centres and teachers. Future replication of the study would benefit from a bigger sample size in order to strengthen the reliability of the findings of the research study (Murray, Pace and Scott, 2004).

4.6 Summary :

The findings indicated that children from both groups improved their scores in all four cognitive tests from pre to post testing. However, the experimental group showed greater improvement in all of the cognitive tests. From the classroom observations of teacher-child interactions, the experimental group showed higher frequency and more varied cognitive function related-verbal expressions than the control group. The experimental teachers scored higher in all three essential components of MLE than the control teachers; there was a marked difference between the two groups in the criteria of transcendence. Finally, the children's response to mediation scores were positively correlated with the post test scores of the experimental group.

CHAPTER 5

DISCUSSION OF FINDINGS

Introduction

This Chapter aims to present the analysis of the data, the investigator's interpretation of the results and provide a reasoned judgment about the findings in relation to the research questions central to this study.

5.1 Overview of significant findings of the research study

This study sought to objectively examine the effects of the Bright Start cognitive curriculum compared with the regular integrated thematic preschool curriculum in increasing children's learning effectiveness and developing cognitive functions that are essential for school learning. Another purpose of this study was to examine teachers' use of mediated learning teaching style and its possible effects on the development of children's cognitive functions.

All the pre to post study results from ACFS, RCPM, Brigance academic/cognitive assessment (Brigance) and Brigance criterion referenced assessment (Brigance 2) appeared to converge on the same outcome with the experimental children making greater improvement from pre to post tests than the children from the control group. This trend is similar to studies on the Bright Start cognitive curriculum previously conducted by Cebe & Paour (2000), Tzuriel et al. (1999), Tzuriel et al. (1998), Paour et al.(1993), and Paour, Cebe and Haywood (2000). This outcome was further substantiated by qualitative data on children's cognitive function-related verbal responses. Not only was there a higher frequency, there were also observations of a wider range of cognitive function-related verbal responses observed in the experimental group than the control group.

These findings appears to support the investigator's hypothesis that children in the experimental group who experienced the Bright Start Cognitive Curriculum yielded greater gains in cognitive functions when compared with the children in the control

group who experienced the regular integrated thematic curriculum. This in turn facilitated greater achievement outcomes in the academic domain from pre to posts tests for the children in the experimental group.

As the preschool age is characterised by rapid growth and changes for almost all children who grow up in supportive early environments (Shonkoff, Phillips, & National Research Council, 2002; Shore, 1997), it is inevitable that developmental changes would take place anyway. As the findings from this research study showed, post tests scores were consistently higher than the pre tests scores for both experimental and control groups. According to Piaget's cognitive development theory, children's thinking progresses through stages of increasingly advanced cognitive processing. However, it is important to take note that the findings from all the tests, as indicated in the previous Chapter, revealed a significant difference in the post test scores with the experimental group showing greater improvements on all the measures.

The findings also showed that there was a correlation between children's responsiveness to mediation and their post test scores. There was evidence to suggest that children who were more responsive to mediation, received higher post test scores.

The experimental teachers' use of the MLE teaching style, a critical component in the implementation of the Bright Start Cognitive Curriculum, appeared to have played an important role of eliciting higher frequency of diverse cognitive function-related conversations among the children.

5.2 Effects of the Bright Start Cognitive Curriculum for Young Children

The effects of the Bright Start Cognitive Curriculum on the children were being examined in terms of the development of cognitive functions and achievement in the academic domain.

5.2.1 Cognitive Functions

The Application of Cognitive Function Scale (ACFS) classification subscale, Raven's Coloured Progressive Matrices (RCPM) and videos were used to take measures of the cognitive development of the children.

Data collected on the ACFS classification subscale showed greater improvement from pre to post intervention for the experimental group than the control group. At the end of the intervention, more children in the Bright Start Cognitive Curriculum programme than the control group children were able to classify objects according to different dimensions, such as size, shape and colour, when asked to classify the objects in different ways. The cognitive functions that were required for classification to be successful involved systematic exploration, precision and accuracy in data gathering, labeling, grouping, comparison and discrimination of relevant information (Haywood, Brooks and Burns, 1992). This study adds to the evidence of the positive effects of the Bright Start Cognitive Curriculum on children's classification skills where they develop the ability to classify objects and people through the dimensions of colour, size and shape (Haywood, Brooks and Burns, 1992).

A similar trend was also detected in the RCPM measures where the children from the Bright Start cognitive curriculum showed greater improvement than the children in the control group. RCPM requires elements of mental process skills such as conservation concepts, reasoning ability, making comparisons, perception, organisation of space, analytical perception of visual stimuli and analogical thinking (Raven, Raven and Court, 1998; Tzuriel et al., 1999). This finding appears to be consistent with those by Paour et al. (1993), Cebe & Paour (2000), Tzuriel et al. (1999) where the children who had Bright Start cognitive curriculum attained significantly higher scores in RCPM than children in the control groups.

From the data collected through videos of children's responses to teaching, the children from the experimental group showed a higher frequency and a wider range

of cognitive function-related verbal expressions than the children from the control group. The most frequently observed cognitive functions in the experimental group included comparison, counting, elaboration, systematic approach, self regulation, classification (see Table 5.1 for illustrations).

Table 5.1

Examples of Cognitive Function Verbal Expressions from the Children in the Experimental Group

Examples	Cognitive Function
Child: “Both plants and animals need air, water and food to grow and live. But plants make their own food but animals have to find their food.”	Comparison
Child during dramatic play. Child: “Ok ! Your pizza will come soon. Six in the pan altogether. Let me count to see if there is enough. One ...two ...three ...four ...five ...six ! Six pizzas in a pan. That is two dollars altogether, Shermaine.”	Counting
Child: “A bat can fly like a bird. But it has hair on its’ body, give birth and have milk. So not like other birds, it is a mammal that can fly.” Child 2: “How about a dolphin? It can swim like other fish, but it give birth and also have milk. I watched on Discovery channel, so dolphins are mammals, not fish, right ?”	Elaboration
Child: “At the supermarket, we have to search systematically so that we can find the thing that we want to buy.”	Systematic approach
Child refers to a game where the children have to depict the movement of the animal in the picture. Child: “We follow different rules, as a leader, you have to hold up the picture, but as player, you have to move	Self regulation

like the animal in the picture.”	
Child 1: “You put the cat, dog, hamster and rabbit in this container, so they belong to a group called mammals.” Child 2: “And they are all animals too.”	Classification

These aforementioned examples perhaps demonstrate Vygotsky’s concept of language as being a psychological tool that aids thinking. Speech is a tool for understanding, clarifying and focusing what is in one’s mind (Bodrova & Leong, 2007). Language is used to create strategies for the mastery of many mental functions, such as attention, memory, and problem solving. From their verbal responses, the children appeared to show awareness of the cognitive functions they were using during thinking discussions. For example, the children identified systematic exploratory behaviours as a strategy for learning during a Bright Start session. This, however, was not observed in the children in the control group. Herein lies the difference, that teachers in the Bright Start group highlighted the use of cognitive functions to the children during interaction. Hence, the children’s cognitive function verbal related responses reflect their understanding of the cognitive functions which may have enhanced their thinking.

The evidence then shows the Bright Start Cognitive Curriculum’s positive contribution to the development of children’s cognition. The development of cognitive functions characterises the concrete operational stage of children (Haywood, Brooks and Burns, 1992). These are also the pre-requisites for learning how to learn. The findings of this study confirms the findings from studies previously conducted by Tzuriel et al. (1998, 1999) where the Bright Start children made significant gains when compared with the control children on various cognitive development tests. See Table 5.1 for examples of cognitive function related verbal responses from the children in the experimental group.

In the control group, on the other hand, the range of cognitive function-related verbal expressions, gathered from frequency count in the video data, appeared to be limited and the most frequent verbal responses observed were labelling, relating past to present and elaboration, See Table 5.2.

Table 5.2

Examples of Cognitive Function Verbal Expressions from the Children in the Control Group

Examples	Cognitive Function
Teacher: "What is this ?" Child: "Clock" Teacher: "What shape is this ?" Child: "Circle."	Labelling
Teacher: "This is a curry leaf, what does it look like to you? " Child: "Looks like the shape of the eye."	Relate past to present
Teacher: "What are the characteristics of boys and girls ?" Children: "They eat, drink, draw, play, sleep, they need food and water."	Elaboration

This may be accounted for mainly by the style of teaching and curriculum delivery where teachers in their interaction with the children aimed to elicit content and knowledge, it would be inevitable for young children's corresponding responses to be related to giving information which would often require the use of skills such as naming, giving labels, elaborating and relating past to present. However when the teachers from the experimental group using the three fundamental parameters of MLE seek to communicate the purpose, the meaning and application of learning, a wider repertoire of skills need to be called upon into use in children's responses beyond just labeling, relate past to present and elaborating.

Most learners have the potential to change or adapt, regulate the way they think, learn and apply their skills in different contexts. The fact that children who participated in the Bright Start cognitive curriculum obtained higher scores and made greater gains in all the measurements than children who did not receive Bright Start cognitive curriculum, suggested that children's cognitive abilities could be enhanced even further through the Bright Start cognitive curriculum.

Feuerstein proposes that cognitive functions, as the mental conditions essential for thinking operations and any other behavioural functions, are best facilitated through mediated learning experience (Feuerstein, et al., 2006). In the light of this, the measures taken by the RCPM and ACFS, suggested that cognitive functions that have been enhanced include systematic exploration, precision and accuracy in data gathering, comparison skills, classification skills, conservation skills and reasoning abilities, all of which, are all important for mathematical and logical thinking. The observations of the videotaped teaching sessions, some examples of which are illustrated in Table 5.1 & 5.2 indicated a more complex use of cognitive functions by the experimental children, which was not found in the video tape observations of the control children.

5.2.2 Achievement in the academic domain

Early childhood education in the Singapore system places emphasis on the development of early literacy and numeracy skills, as it is believed that this underlies academic achievement. The Bright Start Cognitive Curriculum promotes this development too. It has a number concept unit and it is rich in verbal interactions between adult-child and child-child.

Similar to the previous two tests, ACFS and RCPM, data collected on Brigance academic/cognitive and Brigance criterion referenced assessment showed that the experimental group obtained higher post test scores and made greater improvement from pre to post tests than the control group. The children from the experimental group scored better in reading and this could have contributed to a greater

improvement from pre to post study for the Brigance criterion referenced assessment where the measures of reading ability were taken. Hence, there appears to be a transfer of skills. This concurs with the study by Cebe & Paour (2000) study where the results of the reading tests of the children who had received the Bright Start Cognitive Curriculum yielded the convincing evidence of durable transfer effects from grade one to grade three.

It was demonstrated in this study that the children from the Bright Start Cognitive Curriculum were able to generalise the use of cognitive functions to the efficient learning of academic subjects such as reading. In particular, the children seem to have been taught to adopt a systematic approach to learning, apply this to reading passage and sight words.

Previous studies which involved children from low SES, showed that they achieved efficient and effective learning of academic subjects in early school years. (Tzuriel et al., 1999; Paour et al., 1993; Cebe & Paour, 2000 and Paour et al., 2000). These children who were also using the Bright Start Cognitive Curriculum showed significantly greater improvement in cognitive development, knowledge of numbers, intrinsic motivation and several dynamic assessment tests of cognitive development (Tzuriel et al., 1999), general knowledge and reading of novel words (Paour et al., 1993). Follow-up studies of the Bright Start children in Grade 3 (Paour, Cebe and Haywood, 2000) indicated the sustainable effects of the Bright Start programme where the Bright Start children performed significantly better than children from non-cognitive kindergarten programmes in standardised national school achievement examination prepared by the Ministry of Education.

In the integrated thematic curriculum implemented with the children from the control group, the focus of the curriculum was on content learning with the acquisition of skills as a subgoal of teaching. The Bright Start Cognitive Curriculum, on the other hand, focuses on the development of cognitive functions in young children, and the curriculum is organised to address the cognitive functions

with the use of MLE teaching style, directed at helping children to acquire, elaborate and apply the cognitive functions to a variety of content areas and everyday situations (Santiago & Elias, 2004). The findings of this research study appeared to suggest that focused facilitation of cognitive functions and emphasis on the application of the cognitive functions to different contexts, has led to higher post test scores of the children from the experimental group. Hyson, Copple and Jones (2006) have also suggested the idea of a planned, theoretically coherent curriculum, implemented with committed and qualified teachers has made a difference for the children.

This research ended before the children transited to formal schooling and it would have been interesting, if the children did not have to leave for formal schooling, to ascertain whether the effects of Bright Start had been sustained in the subsequent years.

There have been suggestions that early childhood programmes should stress the literacy and mathematical skills that children need in order to succeed in school and beyond (Lonigan, Burgess & Anthony, 2000; Konold & Pianta, 2005). On the other hand, there are other researchers who have pointed out that children's development of focused attention, problem solving and metacognition (Campbell & von Stauffenberg, 2008; Hyson, Copple & Jones, 2006) are also critical to their success in school. Findings from this research study appear to support the latter view, that it equips children with skills for learning through the application of cognitive functions.

5.3 Effects of Teachers' Use of the Mediated Learning Style on the Development of Children's Cognitive Functions

The teachers from the experimental group, having gone through 50 hours of mediated learning experience teaching approach, scored much higher than the control teachers on all Mediated Learning Experience (MLE) components on the

Guidelines for Observing Teaching Interaction checklist except for one component of MLE- affective involvement, where the control teachers scored higher than the experimental teachers and this particular point will be discussed further in the latter part of this Chapter. However, at this point, it is important to note that the experimental teachers scored higher in the three components of MLE, in particular, the components of intentionality, meaning and transcendence, which distinguishes an interaction as a mediated learning experience from other forms of teaching (Feuerstein et al., 2006 and 1980).

Hence, it is not surprising that the findings from this study show significant differences found for the MLE components on task regulation and transcendence between the experimental and control teachers.

The experimental teachers scored significantly higher in the MLE component of task regulation. Task regulation is the way in which the task is presented to the child and includes the instructions offered, the way materials are provided and the manner in which the task is adjusted to promote the child's competence (Lidz, 2003). The mediator would address the strategies that are helpful for doing the task or to offer basic principles of task solution (Lidz, 2003).

The study conducted by Tzuriel et al. (1998) has shown that the Bright Start teachers scored higher than the control teachers on all MLE criteria with significant differences found for the mediation of transcendence.

The following are some examples of how the experimental teachers transcended.
Example 1:

Teacher: Can you tell me when you have to take turns outside school ?

Child: When you queue for a taxi outside shopping centre.

Teacher: And why do you have to take turns ?

Child: If you do not take turns, you will be scolded by other people.

Example 2:

Teacher: When you are outside school, what are the signs that tell you what to do ?

Child: Traffic light, the green light says go, the red light says stop.

Teacher: Why is it important that we do what the sign says ?

Child: The car will knock you and all the cars will crash together.

When giving instructions on how to perform a task, the teacher would include background information about and highlight the basic principles of a task (Lidz, 2003). The following example illustrates this point :

The teacher presented a square to the children and asked them to identify the characteristics of a square, and the children were able to do so by stating that a square has four equal sides and it has four corners. The teacher proceeded to tilt the square and she asked if the shape is still a square, some children mentioned that it is a diamond shape. But the rest of the children said that it is still a square.

Teacher: Why do you say this is still a square ?

Child: No matter how you turn it, it is still a square.

Teacher: When I turn it, what has changed and what stays the same ?

Child: Position has changed

Teacher: Yes, only the position has changed, but this is still a square because it has 4 equal sides and 4 corners.

Note: The basic principle of the task here is constancy.

It was found that both groups of teachers were less competent in two MLE components: change and shared experience. In the investigator's observations, both groups of teachers rarely provided opportunities for children to observe that they had learned successfully and how they have changed as learners. This is a relatively new concept in the local setting and teachers may need to be made more aware of the importance of facilitating children's evaluation of themselves as learners and

make deliberate efforts to mediate this component in their interaction with the children. Besides, it may not be easy for young children to evaluate themselves as learners because this requires some maturity in 'perspective-taking' and the command of language to express themselves.

In Singapore training of preschool teachers, facilitating children's evaluation of themselves as learners is not emphasised as much as encouraging the development of higher order thinking skills using the Bloom's taxonomy's questioning techniques that focus on the six levels of thinking which include facilitating knowledge acquisition, application, comprehension, synthesis and evaluation

According to Green (2006), initiatives to introduce programmes designed to mediate the dispositions and skills associated with effective thinking require teachers to become aware of their own thinking abilities and to enjoy practising the skills of thinking. They need more support and time to make optimal use of programmes and materials designed to 'teach thinking'.

The other component in which teachers from both groups were found to be less competent in was the area of shared experience. Teachers were observed not to share their own thoughts or experiences relevant to the lesson, they tended to pose questions to elicit responses from children, teach concepts or content. While many teachers acknowledge the importance in helping children learn early academic and social skills, they sometimes underestimate the value of their relationships with children as supports for children's healthy development and learning (Gallagher & Mayer, 2008). Sharing between the teachers and the children serve the purpose of enhancing the children's knowledge or experience base (Lidz, 2003) and both parties are engaged in the shared quest of cognitive change in children (Haywood, 1993; Deutsch, 2003; Feuerstein et al., 2006). The impact of teachers not spending enough time to cultivate close relationships with the children and sharing their life experiences may cause children to miss out on learning opportunities which can

include learning problem solving skills and application of the cognitive concepts they have learnt in class to the activities and circumstances of their daily lives.

There were a few probable reasons for teachers not sharing their own thoughts or experiences relevant to the lesson. Firstly, this could be due to the time factor in our child care setting. The daily schedule of a child care programme is usually quite packed with learning activities and routines such as meal time, bath time and nap time. Hence, the teachers tended to adhere to the daily schedule quite closely. Another possible explanation is that the experimental teachers were still in the early stage of paradigm shift of adopting a mediated learning teaching approach and hence, they needed more time and practice in this particular approach.

One area where the control teachers scored marginally better than the experimental teachers is in the MLE component of affective involvement, such as relating to children with warmth and a sense of caring. The experimental teachers were initially switching to MLE style of teaching and therefore more focused on the cognitive goals and the process of mediation. MLE interaction tended to require teachers to elicit justification for children's answers and instances of transcendence or generalisation of skills into new situations. Under such circumstances, the teachers could be perceived as more intense and less warm. Teachers tend to be oriented towards school readiness and often face pressure to get the children ready for transition into primary school. Against such a background, in implementing the Bright Start Cognitive Curriculum, teachers tend to focus more on promoting the cognitive functions. Hence it is not surprising that teacher-children interaction appeared to lack care and warmth and hence this aspect of interaction is scored low. This could have accounted for the experimental teachers' lower score in MLE component of affective involvement.

The Researching Effective Pedagogy in the Early Years (REPEY) (Siraj-Blatchford, et. al., 2002), suggests that settings which practice a good balance of cognitive and social interactions achieve the best profile in terms of child outcome. The cognitive

interactions are characterised by providing children with more experience of academic activities (literacy and mathematics) engaging them in activities with higher cognitive challenge. Here, directed teaching and ‘sustained shared thinking’ interactions or joint involvement are also evident. The social interactions are characterised by more encouragement and social talk. Hence future studies in the Bright Start Cognitive Curriculum could give more attention to the practice of a good balance of these two elements in teacher-mediator interaction with children and also examine the factors that contribute towards positive, engaging and warm interaction with children.

The impact of MLE has also been felt by the teachers who were responsible for implementing the curriculum. This would have an effect on the teachers’ interactions with the children under their care. When the experimental teachers were asked about what were they doing differently as a result of teaching Bright Start cognitive curriculum (see Appendix M), the teachers stated that they became more aware of children’s thinking and learning processes and they tried to use various questioning techniques to facilitate higher order thinking skills and the acquisition of cognitive functions in children. The teachers’ reflection of their teaching techniques in the Bright Start programme depicted the essence of mediation where the purpose was to elicit thinking from the children through the use of process-oriented questioning rather than answer-oriented questioning techniques (Haywood, Brooks and Burns, 1992). As early adopters of meditational teaching styles, the teachers appeared too focused on the techniques of meditation and they have neglected the affect component about being caring and showing warmth towards the children.

5.4 Children’s Response to Mediation

Data collected on children’s responses to mediation scale from the experimental groups only through ratings by their class teachers who were also the experimental teachers, were used to correspond with children’s post test scores. The findings showed that the more responsive the children were to mediation, the better they

performed on the tasks that assessed their learning, in this case, they scored much higher in their post tests scores. Previous studies by Vander Aalsvoort and Lidz (2002 and 2007) have also shown that reciprocity elicits competence with both intellectually impaired children and regular primary school children. Regular exposure to mediated learning experience through the Bright Start curriculum has consistently provided the children with opportunities to reciprocate to the teachers, and to actively engage their cognitive functions in learning tasks. Over time, children's responses show up more clearly in their application of cognitive strategies. For example during the post RCPM, the child pointed to the options as if she would do so in a task related to systematic exploration behaviours.

5.5 The Bright Start Cognitive Curriculum within the play versus formal curriculum continuum

In early childhood education, play has long been regarded as essential to children's learning and development (Bodrova & Leong, 2005; Lally & Mangoine, 2006). Set against the background of integrated thematic curriculum, the Bright Start Cognitive Curriculum is a 30 to 45 min programme that took place daily and the focus of the programme was geared towards fulfilling cognitive goals in a systematic way through a series of game-like, active learning lessons and mediated learning experience teaching approach. The cognitive functions that were learnt for the day were applied during the integrated thematic curriculum and other activities throughout the day. The games, embedded in the Bright Start Cognitive Curriculum, involved purposeful play, with teachers' careful planning and selection of materials and equipment, ensure that children encounter learning experiences as they play (Wood & Attfield, 1996). For example, children participated in a series of games such as *'Fast and Slow'*, *'Busy Bee'*, *'Copy Cat'*, *'Simon Says'* to learn the importance of regulating their behaviours for effective learning and interacting with others. There is however less of a free exploration through play for children during the Bright Start lessons.

Another important value of play and its relationship to learning is play provides a context for developing transferability of knowledge and skills (Wood & Attfield, 1996). Playing games such as *musical chair*, *bingo*, *Who Has My Shoe?*, role play a grocery store in the Bright Start lessons on number concept, enable the children to apply their knowledge about correspondence, using systematic approach, going in order, understanding cardinal number, being precise and accurate, and comparing by counting in play activities (Haywood, Brooks and Burns, 1992).

The Bright Start Cognitive Curriculum does not fall under the formal curriculum of content learning. On the contrary, the Bright Start Cognitive Curriculum emphasises the development of fundamental cognitive processes and metacognition operations. The primary goal for each lesson is to help children to acquire a set of cognitive functions in a systematic and sequential manner. In spite of the structure outlined for each lesson, there is still room for the teacher to vary the lesson to meet the learning needs of the children. In summary, the Bright Start Cognitive Curriculum tends to be structured and teacher-directed with purposeful play incorporated into the daily lessons.

The integrated thematic curriculum implemented with the children from the control group focused more on content learning with the acquisition of skills as a sub goal of teaching. There is also the inclination to prepare children for primary schooling; hence equipping them with the 3Rs of academic skills through the thematic curriculum.

5.6 How has the study added to the existing literature

5.6.1 The mediated learning experience style of teaching

The Bright Start Cognitive Curriculum through the use of mediated learning experience offers a perspective of looking at different contexts as a potential for children to apply thinking processes. As beginning mediators, the teachers from the experimental group, had the tendency to focus on the process of mediation and the facilitation of cognitive functions in young children. While they scored higher in

the three essential components of a mediated learning experience interaction, they were weaker when compared with the teachers from the control group in the other non-essential components of the mediated learning experience, in particular the warmth and care aspects of their interaction with the children. Hence future studies should explore if this is a consistent trend with beginning mediators.

5.6.2 The cognitive function-related conversations

This research study has generated interesting information on the nature of children's "thinking conversations", children's cognitive function-related conversations in observed teaching sessions and classroom activities for both the experimental and control groups. These have revealed that not only was there a higher frequency of cognitive related conversations in the experimental group, there was also a range of higher and more complex cognitive function-related verbal responses. Children's ability to use cognitive function-related conversations indicate that children's thinking has been transformed and they can use the cognitive functions in thinking, solving problems and learning. This research study has provided some insights in the area of dialogic teaching (Alexander, 2007) where talk is used to engage, stimulate and extend children's thinking, and advance their learning and understanding, as well as their cognitive development.

In addition, the multicultural and multilingual context in which this study was situated can contribute to current literature on children's learning in a multicultural and/or multilingual context and their influence on cognitive development.

Not only has this study contributed to literature on studies on the Bright Start Cognitive Curriculum, it has provided information on the wider field of understanding the development of children's thinking through adult-child interaction.

5.7 Summary :

The discussion chapter reveals that there is an agreement between findings in this study with the concepts put forth by the Structural Cognitive Modifiability (SCM) theory. The Bright Start cognitive curriculum for young children has brought about significant impact on the cognitive abilities of the children as well as to the teachers who were responsible for implementing the curriculum. This will have an effect on the teachers' interactions with the children under their care. Situating the findings of the research study in a wider preschool context in terms of the play versus the formal curriculum continuum and on how the study has added to the existing literature have been addressed.

CHAPTER 6

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Introduction

This Chapter presents the conclusions, limitations of the study, recommendations for further research and implications of the study for professional practice.

In the light of the global trends of change, Singapore's education system has to constantly adapt by nurturing a culture of continuous learning in its citizens. This has to begin from the preschool years where thinking skills are cultivated and the eagerness to learn is being developed. With this national agenda for education, the Bright Start cognitive curriculum for young children was adopted and implemented as a research study with the preschool children in a few childcare centres.

The purpose of the research study seeks to investigate the effects of the Bright Start cognitive curriculum on children's cognitive functions and learning effectiveness. The major findings have been summarised in the following paragraphs.

6.1 Summary of major findings of the current study :

All the pre to post tests study from ACFS classification subscale, RCPM, Brigance academic/cognitive assessment and Brigance criterion referenced assessment in this study converged on the same outcome with the experimental children showing greater improvement from pre to post study than the children from the control group.

From the videos of children's cognitive function-related verbal responses, it is apparent that there are some major differences in teaching styles between the two groups. The findings from this study support the use of MLE teaching style and Bright Start Cognitive Curriculum for the development of age appropriate cognitive functions in children. The teachers from the experimental group using the three fundamental parameters of MLE seek to communicate the purpose, the meaning and

application of learning, succeeded in eliciting a wider repertoire of skills in children's responses. In contrast the teaching style of the teachers in the control group elicited a limited range of cognitive functions in children because the focus of the curriculum was on the children's acquisition knowledge of a topic studied; eg. names of animals, characteristics of their physical features etc.

Thirdly, while the evidence from this study indicated teachers in the experimental group scored higher than the teachers in the control group in every component of MLE except in one component. The control teachers who were not trained in MLE appeared to have scored better in a 'non –fundamental' parameter of MLE, affective involvement. Both groups scored poorly on the MLE components of change and shared experiences. The experimental teachers who were trained in MLE and used MLE approach in this study scored better on the three fundamental parameters of MLE and in particularly, the component on transcendence and the non fundamental MLE component on task regulation. This supports Feuerstein's theory which places great emphasis on the importance of transcendence for the development of abstract thinking in children where they apply the cognitive functions they have learnt to new situations and diverse contexts.

Finally, findings from the teachers' evaluation of children's Response to Mediation Scale appeared to be positively correlated with children's post tests scores. By looking into the teachers' perspectives and their evaluation of the children's Response to Mediation has added greater understanding of the richness and complexity of the children's behaviours and learning (Cohen & Manion, 1986).

6.2 Limitations of the current study :

While the objectives of study were achieved and have led to the investigator's conclusion that the Bright Start Cognitive Curriculum has yielded gains in the cognitive functions of young children and led to greater academic achievement, there are some limitations to this study.

An unanticipated event occurred during the course of the research study for both the control and experimental groups, which is referred to as a history threat by Campbell and Stanley (1966). The pretests period was disrupted by an outbreak of Hand, Foot and Mouth disease in the childcare centres. To prevent the spread of the disease, some of the centres in my research study were closed for two weeks and the rest of the centres did not allow for any visitors during that period of time. Hence, this has disrupted the pretest schedule and in turn caused the delay in the implementation of the Bright Start programme and the integrated thematic curriculum. Another event was the graduation and year end concert, it has been a tradition for the graduating children (the children in this research study) to put up performances before they leave the preschool for their primary education. Due to this, some Bright Start lessons towards the end of the research study were disrupted or compressed to make time for concert practice sessions.

Due to time constraints, the research study was conducted over six months with the completion of four out of a total of seven units of Bright Start cognitive curriculum. It would have been better if the research time could have been extended to complete all the seven units. However this was not possible because the children in the research study were being oriented for their enrolment into primary school by the end of 2008.

From the investigator's interviews with the teachers, the children were not yet accustomed to provide justification for their answers and one reason for this could be that some children from non-English speaking homes had difficulties expressing themselves clearly and fluently in English. The Bright Start cognitive curriculum was delivered in the official language of instruction, English. Initially getting children to provide justification for their answers were difficult; in fact, about 40 percent of the children in the experimental group came from non-English speaking background and they did not use English regularly at homes. Hence, they experienced some difficulties in expressing themselves fluently in English language during the Bright Start lessons. The study has highlighted that language as a

‘psychological tool’³ as Vygotsky pointed out, is crucial for children to participate and engage in more complex cognitive operations (Berk and Winsler, 1995; Yang, 2000). In the Bright Start cognitive programme, when children are equipped with language as a psychological tool, they can benefit from the predominantly discussion type of learning that tap on their mental processes and sometimes higher order higher mental processes.

However in a multilingual society such as Singapore, it would be beneficial for young children to be exposed to mediation in their mother tongue too. The home has an important contribution to make to children’s learning and development (Klein, 2003). In the future implementation of the Bright Start cognitive curriculum, consideration should be given to the training of primary caregivers at home. The Bright Start has a parent’s manual as it sees the home as a context for transcendence of cognitive functions. When children are regularly exposed to context of discussion, they would develop more responsiveness and reciprocity towards mediation. Through discussions at home as well as in the preschool centres, children get to transcend the cognitive functions to new situations and diverse (Haywood, 1988).

Future studies may need to consider children from bilingual or multi-lingual backgrounds whose mother tongue differ from the language that they are to be mediated in and how this may affect their understanding and learning of Bright Start cognitive curriculum.

Another limitation of the research study is the choice of outcome measures. They measured predominantly the cognitive domain. For future studies, a broader range of outcome measures of other domains such as self-regulation, social-emotional

³ “Psychological tools are those symbolic artifacts-signs, symbols, texts, formulae, graphic-symbolic devices-that help individuals master their own “natural” psychological functions for perception, memory, attention and so on. Psychological tools serve as a bridge between individual acts of cognition and the symbolic sociocultural prerequisites of these acts.” (Kozulin, 1998, p. 1)

domains would be important to examine as effects of the Bright Start Cognitive Curriculum.

From the investigator's knowledge, the Bright Start Cognitive Curriculum is the only comprehensive cognitive programme for young children with lesson plans that have been clearly and systematically designed. With the well prepared curriculum, it is easy for teachers who are trained in mediated learning experience teaching approach to implement the curriculum efficiently. On the other hand, it is this value offered by the Bright Start Cognitive Curriculum that has caused the investigator to overlook or limit the potential value that other programmes can offer. Future studies, may consider comparing the Bright Start Cognitive Curriculum with other cognitive programmes for young children to examine the effects more clearly and hence limit some of the potential biases that arise.

The research methodology could have included several focus group interviews with the experimental teachers to gather information about their feelings and perspectives about implementing the Bright Start Cognitive Curriculum using the mediated learning experience teaching approach. Such interviews may have enabled the investigator to gain a more in-depth understanding of the quantitative data, like analyzing the data for patterns and themes.

The small sample of 80 children and 5 teachers from five different centres significantly limits the generalisation of this study and a wider sample may confirm the findings or indeed identify some other issues needing further investigation. The small sample size as evident in this study cannot be generalised to wider population but it does yield a rich source of data and this has occurred in this study.

6.3 Recommendations for further research

One important consideration would be to include in the control group more preschool centres that use different curriculum approaches, for example, the thematic approach which is typical in Singapore as well as other approaches such as

Montessori and Project Approach. Comparison of the Bright Start Cognitive Curriculum was somewhat limited in this study, and made with only two centres with 'integrated thematic curriculum'.

Future studies may consider extending the sample size of children to include the different developmental levels, that is children from ages four to six years and to involve more centres in the Bright Start cognitive curriculum implementation.

At present, there are no assessments available that directly assess the curriculum goals that the Bright Start Cognitive Curriculum sets out to achieve, and without the assessment component, the curriculum is incomplete. Further research in developing appropriate curriculum-based assessment is necessary. According to Lidz (2004), curriculum-based measure provides information on what students know, and to what degree have they mastered the content. Curriculum-based measure (CBM) informs teachers, programme planners and administrators of the success of an instructional or intervention procedure. When used for diagnostic purpose, CBM can help to identify individual learners' needs and monitor their responsiveness to the intervention.

Further studies may examine the role of peer mediation in the Bright Start Cognitive Curriculum. In Albert Bandura's social learning theory, social influences in the environment play an important role in the development of the child (Thomas, 1992). Children learn by observing peers who serve as role models. An advantage of having children mediate learning to their peers, is that it allows and encourages children to use the cognitive functions in a meaningful way such as to engage in arguments, share ideas, and work together (Hartup, 1985; Seng, Pou, Tan, 2003; Dangwal & Kapur, 2009). Hence, further studies can look into the specific influence of peers (Tzuriel & Shamir, 2007) and how it might enhance or limit the effectiveness of the implementation of the Bright Start Cognitive Curriculum.

Future studies may also examine the pedagogical style of teachers who develop into thinking teachers through adopting a MLE teaching style approach, specifically how does this approach help teachers to become more aware of their own thinking processes, disposed to think and reason, and enjoy practicing the skills of thinking (Green, 2006).

In adopting a different approach to teaching, and in this case, the mediated teaching style, teachers need time and support to become competent in using this approach and make optimal use of the programme and materials designed to teach thinking (Green, 2006). Teachers cannot be expected to apply programmes and ideas with insight and judgement of those who took years to develop them; nonetheless, a process may have begun, that will eventually result in individual teachers becoming, in their own unique ways, ‘mediated learning experience teachers’ (Green, 2006).

In future implementation of Bright Start Cognitive Curriculum, it may help teachers to firstly have an orientation towards the practice of mediating learning to children before launching into the Bright Start implementation. This would give teachers time, opportunity and a ‘real’ context to adjust to and apply a new paradigm of curriculum delivery. Teachers may also have more opportunities to become equipped with additional relevant techniques and skills, such as asking questions and eliciting answers.

So far the Bright Start programme has been incorporated into the integrated thematic curriculum implementation; where children were exposed to the mediated learning style of delivery for about eight hours per week. This could have posed a disadvantage for the children because it may not have been intensive, continual and consistent (Ramey and Ramey, 2004). In this study, opportunities for application of cognitive functions were regularly disrupted when children switched to integrated thematic curriculum where the teachers did not mediate the cognitive functions consistently. So, future studies may consider adopting a whole centre approach where the Bright Start cognitive curriculum is the main curriculum of the centre,

and daily teacher-child interaction serve as the basis for mediating the use of cognitive functions. When thinking is part of the daily routine, children build up positive attitudes toward thinking and learning (Salmon, 2007).

In a typical integrated thematic curriculum, the focus is on themes such as plants and animals, and skills such as comparison and classification are not explicitly emphasised. However, the emphasis would now be directed towards fundamental cognitive functions that underlie content learning, such as self regulation, comparison, classification etc. The themes would then serve as learning contexts where cognitive functions could be applied, for example, grouping plants, comparing living and non-living things. Cognitive functions now serve as a framework for developing content lessons, which are also contexts for 'bridging'. It is through application that the concepts are learned and made secure to the extent that it is examined, tested, applied and tried out in a variety of contexts (Haywood, Brooks and Burns, 1992).

6.4 Summary :

In this last chapter of the thesis, the limitations of the research study highlighting the choice of outcome measures, research method and ways to limit some potential biases have been addressed. In addition, some recommendations including the role of peer mediation, examining the pedagogical style of the teachers through adopting the MLE approach and adopting a whole centre approach where the Bright Start Cognitive Curriculum is the main curriculum, have been suggested for future studies.

6.5 Conclusion :

There is a growing trend in schools to move away from the traditional rote learning towards the development of critical thinking as they prepare students for the knowledge-based economy (Danubrata & Tan, 2010). At the International Conference on Early Childhood Education 2010 that took place in Singapore, this research study was presented to preschool educators and government officials from

the Ministry of Education, and the effects of the Bright Start cognitive curriculum has drawn a lot of interest from the audience participants. The Bright Start cognitive curriculum is timely in the light of changes in education in the East Asia and Southeast Asia contexts. As it is usually the trend in this country, the government will support the cause if effectiveness is witnessed and proven. Hence, more research studies should be carried out to shed light on the effectiveness of a cognitive approach to early childhood education as has been shown in this research study on the Bright Start cognitive curriculum.

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Appendix A

ACFS classification subscale

Form 6.1 ACFS CLASSIFICATION TASK SCORES: [Core Test]

Building: (One point per item). Items 1-3 apply to use of blocks for building	Pre Test	Post Test
1. Deliberately manipulates or organizes pieces into a building or structure.		
2. Structure includes three or more colors or shapes grouped together.		
3. Structure uses similar pieces for creation of symmetry (e.g., columns).		
Grouping: Items 4-5 apply to use of blocks to form groups. For Child who spontaneously groups blocks, CREDIT ALL OF THE ABOVE. If child does item 4 (1 pt); if item 5 (2 pts), if item 6 (3pts).		
4. Group of blocks, not mixing categories. Color __ Shape __ Size __		
5. Groups some blocks mixing categories. Color __ Shape __ Size __		
6. Groups all blocks mixing categories. Color __ Shape __ Size __		
Regrouping: Items 7-9 apply only when child changes the criteria for grouping blocks. Score 7-9 only if child initially grouped pieces by one of the above criteria.		
7. Color. Regroups three or more pieces by same color. 1 point		
Uses all blocks to group by color. 2 points		
8. Shape. Regroups three or more pieces by same shape. 1 point		
Uses all blocks to group by shape. 2 points		
9. Size. Regroups three or more pieces by same size. 1 point		
Uses all blocks to group by height. 2 points		
TOTAL SCORE Maximum Score = 12	/12	/12

	(% Correct)	(%)	(%)
CLASSIFICATION TOTAL SCORES	Mediat'n	Pre Test	Post Test
Task Pre Test Score Total			
Task Score Post Test Total			
Transfer Score (Post test - Pre test)			
Behavior Score Total (Independent)			
Behavior Score Total (Interactive)			

Appendix B

Academic /Cognitive domain assessment –IED II

ACADEMIC/COGNITIVE	
Number Concepts (p. 85) Basal/Ceiling: Two in a row correct/incorrect if possible.	
Entry: 22+ months (item 1) Entry: 5+ years (item 5)	1. Gives one on request (F-5, 2, p. 152 or K-1, 2, p. 245) 2. Gives one more (F-5, 2, p. 152 or K-1, 1, p. 245) 3. Gives two (K-1, 4, p. 245) 4. Gives three (K-1, 5, p. 245) 5. Gives five (K-1, 7, p. 245) 6. Gives seven (K-1, 9, p. 245) 7. Gives nine (K-1, 11, p. 245)
____/7	
Rote Counting (p. 86)	
Entry: 22+ months	Counts by rote to: (Circle all numbers prior to the first error.) 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 (K-2, numbers 1–20, p. 246)
____/20	
Money (p. 87) Administer all items.	
Identifies Money Entry: 2+ years	Names: (Also give credit on Recognizes Money for all correct responses.) 1. penny 2. nickel 3. dime 4. quarter 5. dollar (K-11a, 1–5 (naming), p. 259)
Gives Monetary Value Entry: 3 years	Tells value of coins and dollar bill: 6. one cent 7. five cents 8. ten cents 9. twenty-five cents 10. one hundred cents (K-11a, 6–10 (monetary value), p. 259)
Recognizes Money	Points to: (Administer only those the child could not name.) 11. penny 12. nickel 13. dime 14. quarter 15. dollar (K-11a, 11–15 (pointing), p. 259)
____/15	
Numeral Comprehension (p. 88) Basal/Ceiling: Three in a row correct/incorrect if possible.	
Entry: 4+ years (item 1) Entry: 6+ years (item 8)	Matches quantity with numerals: 2 1 4 3 5 7 9 6 8 10 (K-4, 1–10, p. 248)
____/10	
Ordinal Position (p. 89) Basal/Ceiling: Three in a row correct/incorrect.	
Entry: 4+ years	Points to: 1. first 2. last 3. second 4. middle 5. third 6. fourth 7. fifth (K-5, 1–7, p. 249)
____/7	
Color Knowledge (p. 90) Basal/Ceiling: Five in a row correct/incorrect.	
Color Identification Entry: 2 years (item 1) Entry: 5+ years (item 6)	Names: (Also give credit on Color Recognition and Color Matching for all correct responses.) 1. red 2. blue 3. green 4. yellow 5. orange 6. purple 7. brown 8. black 9. pink 10. gray 11. white (F-3, colors 1–11, p. 146)
Color Recognition	Points to: (Administer only those colors missed on Color Identification. Give credit for success also on Color Matching.) 12. red 13. blue 14. green 15. yellow 16. orange 17. purple 18. brown 19. black 20. pink 21. gray 22. white (F-3, colors 1–11, p. 146)
Color Matching	Matches: (Administer only the following colors missed on prior subtests.) 23. red 24. blue 25. green 26. yellow 27. orange (F-3, colors 1–5, p. 146)
____/27	

Appendix B

Academic /Cognitive domain assessment –IED II

Academic/Cognitive (continued)

Visual Discrimination (p. 92) Basal/Ceiling: Five in a row correct/incorrect.

Entry: 3+ years (item 1)	Discriminates:
Entry: 4+ years (item 11)	1. <input type="radio"/> 2. <input type="checkbox"/> 3. <input type="radio"/> 4. <input type="radio"/> 5. <input type="radio"/> 6. <input type="radio"/> 7. I 8. P 9. V 10. X (H-1a, 1–10, p. 196)
Entry: 5+ years (item 16)	11. o 12. c 13. c 14. b 15. n 16. on 17. be 18. can 19. they 20. was (H-1b, 1–10, p. 197) _____/20

Recites Alphabet (p. 94) Ceiling: First error.

Entry: 3+ years	Says: (Circle up to first error.) A B C D E F G H I J K L M N O P Q R S T U V W X Y Z (H-2, (26 letters), p. 198) _____/26
-----------------	--

Lowercase Letter Knowledge (p. 96) Basal/Ceiling: Five in a row correct/incorrect.

Identifies Lowercase Letters	Names: (Also give credit on Recognizes Lowercase Letters for all correct responses.) o a d g q b p c e l t i f j n m r h u v w y x z k s (H-5, 1, (26 letters), p. 204)
Recognizes Lowercase Letters	Points to: (Administer only those letters child could not name.) o a d g q b p c e l t i f j n m r h u v w y x z k s (H-5, 2, (26 letters), p. 204) _____/52

Sounds of Lowercase Letters (p. 97) Basal/Ceiling: Five in a row correct/incorrect.

Entry: 5+ years	Produces sounds of: o a d g q b p c e l t i f j n m r h u v w y x z k s (H-5, (26 letters), p. 204) _____/26
-----------------	--

Auditory Discrimination (p. 98) Administer all items.

Entry: 4+ years	Discriminates: 1. b — tab-tab; bit-pit 5. f — fix-mix; fan-fan 9. g — gate-late; sag-sat 2. h — hide-wide; hat-mat 6. d — hid-hid; dab-dab 10. j — jet-wet; just-just 3. s — set-wed; bus-bud 7. n — next-next; nut-mutt (I-7, 1–10, p. 217) 4. m — met-met; sum-sun 8. r — rid-bid; raid-raid _____/10
-----------------	---

Survival Sight Words (p. 100) Basal/Ceiling: Five in a row correct/incorrect.

Entry: 4+ years	Reads: 1. Go 2. Stop 3. In 4. Out 5. boys 6. girls 7. exit 8. enter 9. men 10. women 11. ladies 12. poison 13. walk 14. wait 15. caution 16. danger (I-5, 1–16, p. 212) _____/16
-----------------	---

Basic Preprimer Vocabulary (p. 101) Basal/Ceiling: Five in a row correct/incorrect.

Entry: 5+ years	Reads: 1. a 5. go 9. it 13. to 17. at 21. my 2. and 6. I 10. look 14. what 18. for 22. not 3. can 7. in 11. me 15. with 19. get 23. see 4. do 8. is 12. the 16. you 20. like 24. we (I-1, 1–24, p. 207) _____/24
-----------------	---

Appendix C

Additional criterion referenced assessment from Brigance IED-II

© Curriculum Associates, Inc. Inventory of Early Development-II
I-6a Reads Orally at Preprimer Level

Form A

The little boy said,
"I want to read. I want
to read a big book.
Can I read the big red
book?"

"Yes," said the man.
The little boy said,
"See me read."

© Curriculum Associates, Inc. Inventory of Early Development-II
C-213

Form B

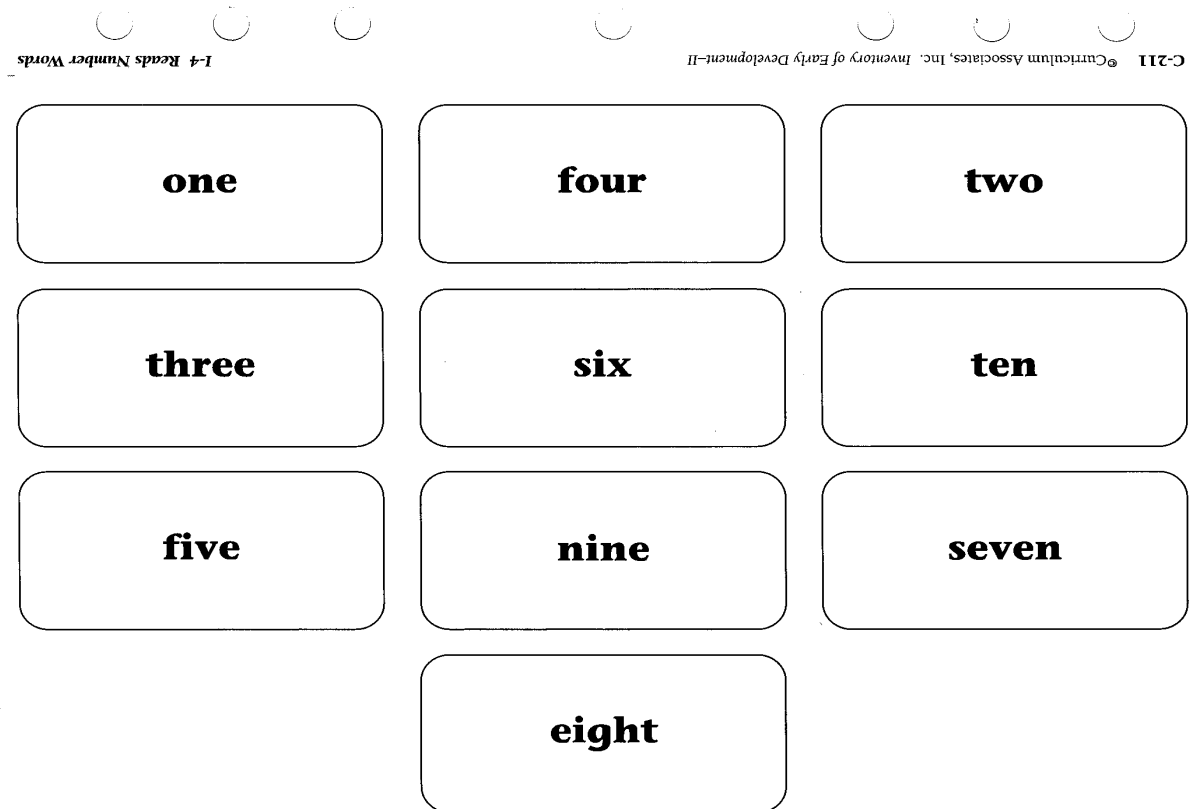
The little girl said,
"I want to read. I like
the blue book."

The man said, "I like
the blue book, too.
Get the blue book."

The little girl said,
"See me read."

Appendix C

Additional criterion referenced assessment from Brigance IED-II



Appendix C

Additional criterion referenced assessment from Brigance IED-II

<small>K-3 Reads Numerals</small>	<small>C-247 ©Curriculum Associates, Inc. Inventory of Early Development-II</small>
<div>3215</div>	<div>51494260</div>
<div>79106</div>	<div>80657861</div>
<div>16192012</div>	<div>891009196</div>
<div>33272139</div>	

Appendix C

Additional criterion referenced assessment from Brigance IED-II

<small>K-7 Writes Following and Preceding Numerals</small>	<small>C-252 Curriculum Associates, Inc. Inventory of Early Development-II</small>
<input type="text"/> 2 <input type="text"/>	<input type="text"/> 8 <input type="text"/>
<input type="text"/> 3 <input type="text"/>	<input type="text"/> 10 <input type="text"/>
<input type="text"/> 1 <input type="text"/>	<input type="text"/> 9 <input type="text"/>
<input type="text"/> 4 <input type="text"/>	<input type="text"/> 7 <input type="text"/>
<input type="text"/> 6 <input type="text"/>	<input type="text"/> 12 <input type="text"/>
<input type="text"/> 5 <input type="text"/>	<input type="text"/> 11 <input type="text"/>

Appendix D

Sample of integrated thematic lesson plan

K2 - Term 3, Observing the World Around Us (III) - Living things and their habitat
Content Focus 2 - There are many kind of animals



Environmental Awareness

Lesson 7: Mammals and Fish

Content Focus 2	There are many kinds of animals
Sub-focus	Features and characteristics that differentiate one kind of animal from another
Learning outcomes	1. Form explanations and communicate scientific information.
Time frame	1 hr
No. of children	15

Lesson Objectives

1. Children will be able to record their observation about the characteristics of mammals and fish.
2. Children will be able to offer explanation base on prior knowledge about animal groups.

What to prepare

- Song/rhyme - Three Blind Mice and School of fish (use the CD Provided)
- Writing materials - papers, pencils, coloured pencils
- Creative writing exercise book
- Picture cards of live animals - mammals and fish
- Creative writing exercise book

What to do

Tuning-in:

1. Gather the children in a circle and sing the rhyme, the three blind mice to the beats of the African drum.
2. Children can move as mice suggested by the music. Ask children, "Do you know which animal group mice belong to"?
3. Children may or may not know the correct answers, but do accept other responses from them, and allow them to revisit their responses as the lesson progresses.



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Appendix D

Sample of integrated thematic lesson plan

K2 - Term 3, Observing the World Around Us (III) - Living things and their habitat
Content Focus 2 - There are many kind of animals

Lesson development:

4. Excite the children by bringing a live fish and hamster to the classroom. Keep these animals in a cage and in a glass bowl.
5. Allow children to observe the animals and talk about their body coverings. E.g. hamster's body is covered with hair and the body of a fish is covered with scales.
6. Get the children to observe the movements of these two animals and get them to describe the animal movements. E.g. the fish swims, a hamster runs.
7. As the children discuss, record their responses in a mahjong paper.
8. Continue the discussion with pictures or specimens of real mammals and fish. E.g. rabbit, mice, seahorses and eels for discussion. (Young children are able to describe differences in animals when they are shown live specimens).
9. Compare the characteristics of a rabbit and mice with that of a hamster. Record children's response on a mahjong paper.
10. Compare the characteristics of a fish with that of an eel and a seahorse. Record children's response on a mahjong paper.
11. Help children to group these animals based on their characteristic into the respective category using the Venn Diagram (Annex 7a)
12. Explain to children that the rabbit, mice and hamster are mammals. Inform children that the mammal is a specific group in the animal kingdom.
13. Provide the same kind of experience to help the children classify seahorse and an eel in the fish category. Fish is another specific animal group that belongs to the Animal kingdom.
14. Highlight to the children that mammals have special characteristic that is they nurse their babies with milk, have hair even if it is little.
15. Inform the children that these are the only characteristics required of all mammals, but most mammals bear live young, have differentiated teeth, and have four limbs (two legs and two arms, four legs, or a pair of flippers and fins).
16. Draw the children's attention to the fish category. A fish is a backbone animal living mostly in water. They are able to swim and glide in water and they have a mouth, jaw and teeth. (Note: Dolphin is not a fish it's a mammal and produces sound).
17. Question for discussion and focus



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Appendix D

Sample of integrated thematic lesson plan

K2 – Term 3, Observing the World Around Us (III) – Living things and their habitat
Content Focus 2 – There are many kind of animals

- Do you know the name of this animal? (Show one animal at a time)
- How do you know that this animal is a hamster/fish?
- What does a fish use for swimming in the water?
- What does a hamster needs for running around?
- Why do you think a hamster does not have a fin?
- Why do you think a fish does not have legs?
- How is the hamster's skin different from the fish?
- Do these animals breathe like you? Why? (Review this question with the task card used in lesson2 of content focus 1)
- How is the fish similar to the seahorse and the eel?
- How is the hamster similar to the rabbit and the mice?
- Do these animals live in the same place? Why?

Closure:

The children can choose to draw and write about the fish and the mammal specimens exhibited at the science centre. Encourage the children to write about the differences in the features and characteristics of these animals. Use the language exercise book for this activity.

Parental Involvement

Please see Appendix 7C

NTUC Childcare



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Appendix E

Sample of the Bright Start Cognitive Curriculum for Young Children

Lesson 17

COGNITIVE FUNCTIONS

1. COMPARING ON MULTIPLE DIMENSIONS
2. DEMONSTRATING PRECISION AND ACCURACY — RECEPTION AND EXPRESSION

RATIONALE

The purpose of this lesson is to give the children more experience with the process of comparing on several dimensions — first, gathering clear and complete information, then, being precise and accurate in their expression of that information, and following the whole sequence of comparing all items to discriminate similarities and differences within the same stimuli. This lesson is designed to be repeated as often as necessary so that children may internalize the process of such complex comparison.

MAIN ACTIVITY

a. Draw or cut out shapes to make the following arrangement of figures on the chalkboard or construction paper. Use blue for the shapes shown in black and red for the shapes shown in white.

Ask the children to look carefully, describe what they see, and discuss how the rows are like the ones for the previous lesson and how they are different.

b. Call attention to the fact that each row has its own model on the left. Ask the children what they think they are supposed to do.

c. Ask the children to say in what ways each figure in a row is like the model, and in what ways each figure is

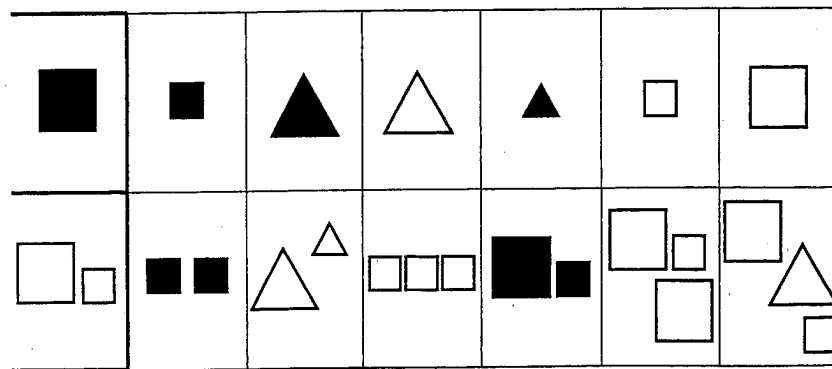
different from the model. Be sure that they discuss the dimensions of color, size, shape, number, and position, even though position does not vary in this lesson.

d. Ask the children to use a black marker to make a dot over each figure for each way the figure is like the model. Have them use a red marker to write a dot under each figure for each way the figure is different from the model. For example, the first figure in the top row is like the model with respect to: shape — both are squares, color — both are red, number — there is one figure in each, and position — both sit on a side; so 4 black dots would go over that figure. They differ only with respect to size, so one red dot would go under that figure. Discuss each figure, and ask the children to say how they knew how many dots to make.

VARIATION

Give the children new copies of the arrangements of figures, and red and black marking pens. Ask them to make their own rules to mark the figures according to how they are like and unlike the model. Afterwards, ask the children to explain their rules.

Point out that one can make arbitrary rules that can then be followed systematically to make comparisons.



Appendix E

Sample of the Bright Start Cognitive Curriculum for Young Children



GENERALIZING ACTIVITY

Shuffle a large stack of half sheets and whole sheets of colored construction paper of two colors. Select as your models a whole sheet of one color, and a half sheet of the other color.

Ask the children to place in a stack by each model the sheets that are the same color as one model and the same size as the other. Discuss with them why each resulting stack will have some sheets that do not exactly match the model. (*The same color stack will have some sheets of the wrong size, and the same size stack will have some sheets of the wrong color.*) Ask the children what could be done about this. (*We could make four models instead of two.*)

This activity demonstrates how comparison is a step in classification.

BRIDGING DISCUSSION

Create a classroom game, comparing the children themselves to show how comparison on one dimension leads to one grouping and comparison on another dimension leads to a different grouping.

Ask a boy who is wearing a light-colored shirt and a girl who is wearing some dark-colored clothing to stand in front of the group. Ask all the children wearing light-colored clothing to stand with the boy, and all those in the room who are wearing dark-colored clothing to stand with the girl. Then change the dimension to shoe style or color.

Ask the children how many things they had to think about in order to make the groups. Ask for other times when one has to think about more than one thing in order to compare carefully. Some examples are when buying soap at the store — does it have perfume or is it scentless; is it powder or is it liquid; is it less expensive to buy the large size?; or when choosing a wheel toy for outdoor time — is that what I want to do; is it a good day for this toy; is this one that I can ride?

OTHER BRIDGING DISCUSSION

School:

Home:

Peer group:

Other:

COGNITIVE MASTERY CRITERIA

Each child should be able to (1) compare on at least three dimensions of similarity and difference, and (2) describe the similarities and differences precisely and accurately, using the abstract labels of size, shape, color, number, and position.

Appendix F

Procedures for administering ACFS

Materials required :

Form 6.1 ACFS Classification task scores for each child and a set of coloured wooden blocks. See Appendix A.

Time : 15 min. to 20 min. per child and test administered individually by researcher.

Instructions :

1) Establish rapport with child and present a set of coloured wooden blocks to each child and asked the following questions :

- Show me what you can do with these blocks.

Assessor to observe if child deliberately manipulates or organises pieces into a building or structure.

- Can you show me how you group these blocks ?

- What is a name for this group ?

- Can you show me another way that you would group these blocks ? (referring to regroup)

- What is the name for this group ?

Scoring :

ACFS uses raw scores and calculations of percent of items correct. Since I was using the ACFS subscale as a static assessment, only the raw score calculations were applicable. Accomplishment of each step within a task earns 1 point. The scores for the completed tasks were summed up for pretest and subsequently for post test. Both the scores were recorded.

Appendix G

Procedures for administering RCPM

Materials required : a copy of RCPM and an answer sheet.

Time : 20 min. per child, test administered individually by researcher

Instructions :

- 1) Establish rapport with child
- 2) The child is asked to look at the top figure on the page and assessor will say that it is a pattern with a piece cut out of it. There are 6 pieces found at the bottom of the page but only one of them is the right piece that fits into the pattern and point to the correct piece.
- 3) The child will proceed to complete the entire booklet from A1 to B12 with a total of 36 items. The test is administered statically where the assessor is not allowed to assist the child to derive the correct answer.

Scoring :

One point is allocated to every correct item. The scores were summed up for pretest and subsequently for post test. Both the raw scores were recorded.

Appendix H

Procedures for administering Brigance IED-II

Materials : Academic/ Cognitive domain assessment. See Appendix B.

Time : 20 min. per child, test administered individually by researcher

Instructions :

- 1) Establish rapport with child
- 2) Follow the assessment procedure provided in the examiner's book
- 3) Record the assessment data.

Scoring :

One mark will be given to each correct item and the raw score will be obtained.

Appendix I

Guidelines for Observing Teaching Interaction

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EARLY CHILDHOOD ASSESSMENT

Guidelines for Observing Teaching Interactions

These guidelines describe interactions of teachers with students that can be described as mediated learning experiences. *Mediated learning experience* is a term used by Feuerstein and his colleagues to summarize interactions that optimize learning and cognitive development; these interactions help children to become self-regulating, strategic problem solvers and competent symbolic thinkers. These guidelines are primarily for use by school psychologists in the role of either teacher consultant or student assessor. The information is to be shared collaboratively with teachers who request such feedback or to enable consultants to develop hypotheses regarding the effects of the instructional environment on a referred pupil's performance; it is not intended as a report card for teachers.

TEACHER'S NAME: _____ DATE OF OBSERVATION: _____
 LOCATION: _____ LESSON: _____
 OBSERVER: _____ PUPIL'S NAME (if appropriate): _____

*Observe teacher throughout the course of an entire lesson. (write NA if item does not apply)
 Use the following rating scale and record additional descriptive comments below:*

	4.....3.....2.....1				
	evident	evident at	evident at	not evident	
	at high level	moderate level	emergent level		
1. Teacher provides clear message to students of intention to engage them in a lesson	4	3	2	1	
2. Teacher successfully maintains the attention of the students throughout the course of the lesson	4	3	2	1	
3. When students lose attention, teacher at times goes beyond stating the need to pay attention and provides a reason or basic principle (e.g., so you'll know what to do).	4	3	2	1	
4. Teacher provides appropriate tangible/visible props to support the lesson	4	3	2	1	
5. Teacher uses voice, gesture, and movement to liven the presentation of the lesson	4	3	2	1	
6. Teacher specifically points out features and elements of materials and content that are important to note	4	3	2	1	
7. Teacher goes beyond labeling what is presented to students to provide elaborations that enhance perceptions (e.g., do you hear rhythm of this poem?)	4	3	2	1	

Form 2.3

Appendix I

Guidelines for Observing Teaching Interaction

OBSERVING CHILDREN, PROGRAMS, AND TEACHERS

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8. Teacher promotes thinking that connects the lesson to previous experiences	4	3	2	1
9. Teacher promotes thinking that connects the lesson to future experiences	4	3	2	1
10. Teacher promotes cause-effect thinking (looking backward from present observation)	4	3	2	1
11. Teacher promotes hypothetical and if . . . then thinking (looking forward from present observation or thought)	4	3	2	1
12. Teacher expresses awareness of pupil's experiences or perspectives (what student might be thinking or feeling)	4	3	2	1
13. Teacher shares own thoughts or experiences relevant to the lesson	4	3	2	1
14. Teacher joins pupil's learning experience as a learner, self-talking through a problem-solving situation	4	3	2	1
15. Teacher clearly communicates the purpose of the lesson in terms of what the pupil is expected to learn; this outcome includes processes	4	3	2	1
16. Teacher's organization or plan of the lesson is clear	4	3	2	1
17. Teacher promotes strategic thinking in the students (e.g., asking "how" questions, suggesting strategies)	4	3	2	1
18. When giving instructions about how to perform a task, teacher includes information about basic principles of the task	4	3	2	1
19. Teacher helps students who don't know how to proceed to develop competence in ways that help students arrive at improved performance	4	3	2	1
20. Teacher offers positive comments and encouraging remarks	4	3	2	1
21. Teacher's remarks about student performance include feedback about what worked (and what did not), i.e., informed feedback	4	3	2	1
22. Teacher elicits thinking and responses from students and does not disproportionately "talk at" them	4	3	2	1
23. Teacher succeeds in creating and maintaining a "challenge zone," of being slightly ahead without overly frustrating students	4	3	2	1
24. Teacher reads students' behavioral cues and is responsive to student behaviors and needs, responding in a timely and appropriate way (this includes providing adequate "wait time")	4	3	2	1

Form 2.3 (continued)

Appendix I

Guidelines for Observing Teaching Interaction

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EARLY CHILDHOOD ASSESSMENT

25. Teacher is able to balance needs of higher performers with those of students with greater need	4	3	2	1
26. Teacher relates with warmth and a sense of caring	4	3	2	1
27. Teacher provides opportunity for students to observe that they have learned successfully and how they have changed as learners (e.g., using examples of their work to note growth)	4	3	2	1
28. Teacher provides opportunities for students to reflect on how they arrived at an answer or solution and not just what the right answer is; this includes requests to justify answers or responses	4	3	2	1
29. Teacher's requests or questions promote integration of information from more than one source	4	3	2	1
30. Teacher provides opportunity for students to summarize their learning experiences	4	3	2	1
31. Teacher evaluates student learning of lesson objectives before moving on (includes checking that students have necessary prerequisite knowledge and skills to engage in new learning)	4	3	2	1
32. Teacher's interactions promote self-regulation and promotion of personal responsibility for actions	4	3	2	1
33. Nature of lesson and selection of materials promotes active involvement of students	4	3	2	1
34. Content of lesson allows for alternative responses and solutions	4	3	2	1

Summary of TEACHER INTERACTIONS:

Summary of CLASSROOM ENVIRONMENT:

Describe STUDENT PARTICIPATION and RESPONSIVENESS:

RECOMMENDATIONS:

Form 2.3 (continued)

Appendix I

Guidelines for Observing Teaching Interaction

PROFILE OF CLASSROOM MEDIATED LEARNING EXPERIENCES

[average the items from the guidelines, record observations with different color for each, and create a key to associate color with time]

Time 1: Date: _____ Color: _____
 Time 2: Date: _____ Color: _____
 Time 3: Date: _____ Color: _____
 Time 4: Date: _____ Color: _____

Intent	4	3	2	1
Items: 1, 2, 3				
Meaning	4	3	2	1
Items: 4, 5, 6, 7				
Transcendence	4	3	2	1
Items: 8, 9, 10, 11				
Joint Regard	4	3	2	1
Items: 12, 14				
Shared Experience	4	3	2	1
Items: 13				
Task Regulation	4	3	2	1
Items: 15, 16, 17, 18, 28, 29, 30, 34				
Praise and Feedback	4	3	2	1
Items: 20, 21				
Challenge	4	3	2	1
Items: 23				
Change	4	3	2	1
Items: 27				
Differentiation	4	3	2	1
Items: 19, 22, 31, 32, 33				
Contingent Responsivity	4	3	2	1
Items: 24, 25				
Affective Involvement	4	3	2	1
Items: 26				

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Form 2.3 (continued)

Appendix J

Children's Response to Mediation

EARLY CHILDHOOD ASSESSMENT

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Response to Mediation Scale

Child's Name:

Age:

Rater:

Location:

Date:

Task/Activity:

This scale is designed to describe the response of individual children to mediational interactions with teachers, assessors, or parents. The scale is intended to complement the Mediated Learning Experience Rating Scale and should be completed following an observation of at least 10 min during an activity shared between the child and the mediator. The scale describes the child's contributions to the interaction, as well as changes in the child in response to changes in mediational experiences. The child is rated on all components for each observed activity.

The intended outcomes of a mediated learning experience are the child's development of self-regulation, strategic problem solving, active learning, and representational thinking. This scale is designed to reflect these outcomes. [This is a research edition; feedback from researchers is welcome.]

A. Self-regulation of attention

1. Unable to maintain attention to task
2. Fleeting attention to task even with input from adult
3. Maintains with significant input from adult
4. Maintains with occasional input from adult
5. Maintains with no input from adult
- * Does not apply

B. Self-regulation of motor activity

1. Impulsive to point of disruption
2. Impulsiveness needs significant restraint from adult
3. Impulse control needs moderate restraint from adult
4. Impulse control needs minimal restraint from adult
5. No evidence of difficulty with impulse control
- * Does not apply

C. Self-regulation of emotions

1. Extreme emotional lability; difficulty self-calming
2. Significant emotional lability; difficulty self-calming
3. Minimal emotional lability; able to self-calm
4. Rare emotional lability; able to self-calm
5. No evidence of emotional lability
- * Does not apply

Form 6.3

Appendix J

Children's Response to Mediation

DYNAMIC ASSESSMENT

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- D. Strategic problem solving
 - 1. Does not engage in any organized manner with task
 - 2. Engages, but uses trial and error approach
 - 3. Pauses for seeming momentary reflection before proceeding
 - 4. Some evidence of planful, organized task involvement
 - 5. Clearly planful and well organized approach
 - * Does not apply
- E. Evidence of self-talk when working on challenging task
 - 1. No evidence
 - 2. Makes noises, but these express effort, not task
 - 3. Verbalizes, but content is not task related
 - 4. Makes task-related comments
 - 5. Task-related comments guide efforts at task solution (this includes comments that may be muttered and not totally clear)
 - * Does not apply
- F. Interactivity with the mediator
 - 1. Does not engage in turn-taking communications
 - 2. Minimal engagement in turn-taking communications
 - 3. Moderate engagement in turn-taking communications
 - 4. Comfortable, frequent engagement in turn-taking communications
 - 5. Initiates and responds appropriately and expansively in several chains of conversational interactions
 - * Does not apply
- G. Responsiveness to initiations of mediator
 - 1. Resistive to mediator's initiatives
 - 2. Passive noncompliant
 - 3. Passive, minimally responsive
 - 4. Consistently responsive
 - 5. Enthusiastic and responsive
 - * Does not apply
- H. Comprehension of the task
 - 1. No evidence of task comprehension
 - 2. Willing imitator, but needs model, demonstration, or move through
 - 3. Slow to comprehend, but does eventually get it
 - 4. Average comprehension of task
 - 5. Quick to comprehend task
 - * Does not apply

Form 6.3 (continued)

Appendix J

Children's Response to Mediation

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EARLY CHILDHOOD ASSESSMENT

DYNAMI

- I. Response to challenge
 - 1. Refuses, cries, or tantrums in response to challenge
 - 2. Begins, but quickly gives up
 - 3. Persists, but with significant encouragement from adult
 - 4. Persists and completes task, with minimal adult encouragement
 - 5. Energized by challenge; enjoys the challenge
 - * Does not apply
- J. Use of adult as a resource when child needs help
 - 1. Does not refer to adult
 - 2. Nonverbally, passively signals need for help
 - 3. Nonverbally actively seeks help
 - 4. Verbally asks for help
 - 5. Actively seeks help and seems to appreciate help provided
 - * Does not apply
- K. Interest in activity materials
 - 1. Shows dislike of materials
 - 2. Neutral reaction to materials
 - 3. Minimal interest in materials
 - 4. Fluctuating interest in materials
 - 5. Consistently strong interest in materials
 - * Does not apply

NOTES:

Lidz, Carol S. *Early Childhood Assessment*. Copyright 2003, John Wiley & Sons.

Form 6.3 (continued)

Appendix K

Adaptations of the Bright Start lesson with the use of local materials

Congkat



Congkat



Kuti- Kuti game



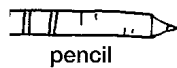
Appendix L

Supplementary tasks to meet the developmental needs of the children

Hidden pictures puzzle

Having fun washing the car

Look for these things in the big picture.



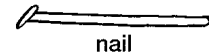
pencil



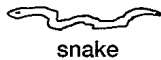
slice of pie



torch



nail



snake



tack



hamburger



slice of bread



American football



ice-cream cone



banana



slice of pizza



hotdog



glove

23

Appendix L

Supplementary tasks to meet the developmental needs of the children

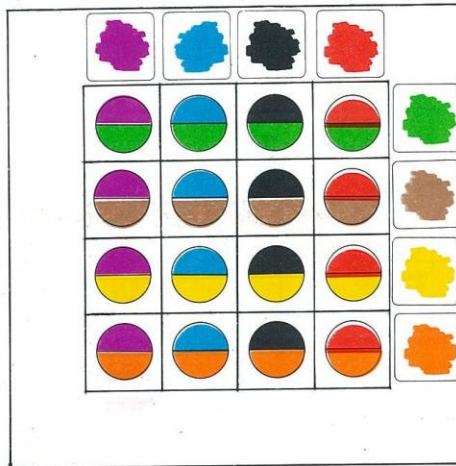
Classification Matrix Task (Stachel, 1973)

SET No. 3.

The set contains: 8 marginal cards (colour spots).
28 intersection cards.

Properties: colour combinations (reference to two directions).

Vocabulary: sentences using the word "and".



Stage 1.

Place any marginal cards with colour spots along the top margin of the board (order of colours is irrelevant).

Place the other 4 colour cards down the left or right hand margin. Out of the intersection cards, select for use 16 on which the pictures feature colour combinations corresponding to the combinations possible between the colour spots of the rows and those of the columns. Lay aside the remaining 12 cards, whose colour combinations do not fit the board layout. (These can be used for another arrangement of marginal cards).

Say to the child: Here are cards with pictures of balls. Each ball has two different colours. Now, put each ball in the right square.

Tell the child to pick up one card at a time, name the colours of the ball, and place the card in the square where these colours intersect. Ask him to give a reason for his action. Transfer the card to another square and wait for the child's reaction. If he disagrees, ask him to give his reasons. If he approves, explain why he is mistaken.

Stage 2.

Change the position of the marginal cards, moving some from the top to the side and vice versa.

Put face down, ready for use, the 16 cards the child used in the first stage of the game.

Tell the child to pick up one card at a time, name the colours of the picture on it, and place the card in the correct square.

The child will now find that some cards cannot be placed on the board because the marginals with the card's two colours are both in rows or both in columns.

Let the child try to find ways of placing the card. In the end, unless he already has suggested laying the card aside because "there is no place for it", tell him he should do just this.

When the child has picked up all the 16 intersection cards, he will find that certain squares on the board have remained vacant, while beside the board, cards are lying that could not be placed. Now suggest using the remaining 12 intersection cards to fill up the board.

Appendix M

Interview with teachers from the experimental group:

The responses to question one have provided insights into using MLE (mediated learning experience) in facilitating children's learning and the teachers' knowledge and skills as mediators. The teachers' responses to questions two and three have provided further evidence about children's learning, their acquisition of cognitive functions and their transfer of learning to other situations or other content area learning.

1) What are you doing differently as a result of teaching Bright Start cognitive curriculum?

Incident 1 June 2008:

Teacher 1: Teaching of cognitive skills is not confined to only during lesson time, it can take place even during routine, such as mealtime and bathing time, where I facilitate and enhance cognitive skills in children.

Incident 2 August 2008 :

Teacher 1 : I am more aware of my teaching strategies and I am more concerned with how children think and their process of learning rather than content knowledge and products of learning. I am more sensitive towards children's thinking.

Incident 1 June 2008:

Teacher 2 : I am more aware of children's thinking and learning process. I try to use various questioning techniques to facilitate children's thinking process.

Incident 2 August 2008 :

Teacher 2 : I try to anticipate the children's thinking and formulate questions to promote their thinking.

Incident 1 June 2008 :

Teacher 3 : I try to restrain the impulsivity of children, improve on my questioning techniques, promote transcendence, give clear directions, plan my instructions, and analyze children's behaviours.

Incident 2 August 2008 :

Teacher 3 : I am able to be more intentional in my questioning techniques especially in eliciting answers from the children. A lot of repetition is needed to reinforce a cognitive function. I need to be focus and seize every opportunity to build their cognitive functions.

2) What were children's responses ?

Teachers : In the beginning, the children were not comfortable with so many questions posed and they were not accustomed to provide justification for their answers. Moreover, the lessons from the Bright Start cognitive curriculum involve more discussions rather than hands on learning. In the beginning, the children were not accustomed to this way of learning and they became disinterested. However, at a later stage, they became more confident in sharing their views, they started to pose more questions and became accustomed to answer questions. They were even able to provide reasons for their answers and support with relevant evidence.

3) Which cognitive functions have the children acquired ? Please provide examples.

Teacher 1 : They are very good at classification and number concepts. The emphasis on self regulation in Bright Start cognitive curriculum, in particular, using systematic exploratory behaviours where children have to look from left to right and top to bottom, has helped to sustain their attention span and enable them to learn number concepts more readily as compared to my experience with children who have not learned self regulation skills. Self regulation has helped the children to be more efficient and effective in their learning.

Teacher 2 : The children engage in spontaneous comparative behaviours very readily where they look out for similarities and differences simultaneously. They are also better regulated during lesson time, mealtime and they can articulate very well how they should behave in school, at home and in public places.

Teacher 3 : The children are really good at spontaneous comparative behaviours where they look out for similarities and differences simultaneously but they are not very competent in classification skills. They appeared to have learnt systematic exploration very well and they constantly refer to this even till the end of the intervention programme.

Appendix N

Definition of MLE components

Mediated Learning Experience Rating Scale (MLERS) (Lidz, 2003) – describes 12 components of adult-child interactions that promote the development of higher mental functioning in children. These components consist of :

- 1) Intent- communication contain elements of soliciting and maintaining attention, stating clearly that the mediator wishes to involve the child in an activity, and promoting self regulation of attention in the child.
- 2) Meaning- this involves use of tangible props, as well, as use of voice and gestures to enliven the communication; it also involves highlighting what is important and what should be noticed.
- 3) Transcendence- this involves building bridges of thinking between experiences and events. It also encourages the child to consider implications and to make inferences, as well as to speculate about possible events.
- 4) Joint regard- this involves trying to see and state the situation from the point of view of the child, as well as trying to experience the situation as a learner-collaborator.
- 5) Shared experience - this involves the mediator's sharing his/her own thoughts or experiences that relate to what is occurring in the interaction with the child with the purpose of enhancing the child's knowledge and experience.
- 6) Task regulation – this involves helping the child consider if a plan is needed and to make that plan, as well as to consider what the best strategy might be. All plans and strategies should be evaluated. This also involves giving a basic principle of task solutions when appropriate.
- 7) Praise/ encouragement – in addition to offering praise and making encouraging remarks, the mediator needs to offer specific information about what seemed to work or not work about the child's approach to the activity.
- 8) Challenge – this involves the mediator's ability to keep the demands of the interaction within the child's zone of proximal development.
- 9) Change – this involves communicating to the child that he or she has successfully learned as a result of this interaction. Actual before-after

products can be reviewed with the child to demonstrate growth and change, or it may involve a statement of what changed and how well the child learned.

- 10) Differentiation - it describes the extent to which the task remains the child's rather than the teacher's. The purpose is to help the child to have a good experience or learn something.
- 11) Contingent responsiveness – this refers to the mediator's ability to respond in a timely and appropriate way to the child.
- 12) Affective involvement – this is the warmth factor and it represents the sense or expression of affection that the mediator conveys to the child.

Appendix O

Statistical computation-RCPM

Tests of Within-Subjects Effects

Measure: RCPM

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
prepost	Sphericity Assumed	898.433	1	898.433	139.719	.000	.642
	Greenhouse-Geisser	898.433	1.000	898.433	139.719	.000	.642
	Huynh-Feldt	898.433	1.000	898.433	139.719	.000	.642
	Lower-bound	898.433	1.000	898.433	139.719	.000	.642
prepost * group	Sphericity Assumed	389.933	1	389.933	60.640	.000	.437
	Greenhouse-Geisser	389.933	1.000	389.933	60.640	.000	.437
	Huynh-Feldt	389.933	1.000	389.933	60.640	.000	.437
	Lower-bound	389.933	1.000	389.933	60.640	.000	.437
Error(prepost)	Sphericity Assumed	501.561	78	6.430			
	Greenhouse-Geisser	501.561	78.000	6.430			
	Huynh-Feldt	501.561	78.000	6.430			
	Lower-bound	501.561	78.000	6.430			

Tests of Between-Subjects Effects

Measure: RCPM

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	99461.251	1	99461.251	1710.617	.000	.956
group	379.051	1	379.051	6.519	.013	.077
Error	4535.192	78	58.143			

Appendix O

Statistical computation-ACFS

Tests of Within-Subjects Effects

Measure: ACFS

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
prepost	Sphericity Assumed	86.022	1	86.022	26.829	.000	.256
	Greenhouse-Geisser	86.022	1.000	86.022	26.829	.000	.256
	Huynh-Feldt	86.022	1.000	86.022	26.829	.000	.256
	Lower-bound	86.022	1.000	86.022	26.829	.000	.256
	Upper-bound	86.022	1.000	86.022	26.829	.000	.256
prepost * group	Sphericity Assumed	68.097	1	68.097	21.239	.000	.214
	Greenhouse-Geisser	68.097	1.000	68.097	21.239	.000	.214
	Huynh-Feldt	68.097	1.000	68.097	21.239	.000	.214
	Lower-bound	68.097	1.000	68.097	21.239	.000	.214
	Upper-bound	68.097	1.000	68.097	21.239	.000	.214
Error(prepost)	Sphericity Assumed	250.089	78	3.206			
	Greenhouse-Geisser	250.089	78.000	3.206			
	Huynh-Feldt	250.089	78.000	3.206			
	Lower-bound	250.089	78.000	3.206			
	Upper-bound	250.089	78.000	3.206			

Tests of Between-Subjects Effects

Measure: ACFS

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	3564.208	1	3564.208	342.042	.000	.814
group	42.508	1	42.508	4.079	.047	.050
Error	812.791	78	10.420			

Appendix O

Statistical computation-Brigance

Tests of Within-Subjects Effects

Measure: Brigance

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
prepost	Sphericity Assumed	10642.278	1	10642.278	160.400	.000	.673
	Greenhouse-Geisser	10642.278	1.000	10642.278	160.400	.000	.673
	Huynh-Feldt	10642.278	1.000	10642.278	160.400	.000	.673
	Lower-bound	10642.278	1.000	10642.278	160.400	.000	.673
prepost * group	Sphericity Assumed	892.028	1	892.028	13.445	.000	.147
	Greenhouse-Geisser	892.028	1.000	892.028	13.445	.000	.147
	Huynh-Feldt	892.028	1.000	892.028	13.445	.000	.147
	Lower-bound	892.028	1.000	892.028	13.445	.000	.147
Error(prepost)	Sphericity Assumed	5175.165	78	66.348			
	Greenhouse-Geisser	5175.165	78.000	66.348			
	Huynh-Feldt	5175.165	78.000	66.348			
	Lower-bound	5175.165	78.000	66.348			

Tests of Between-Subjects Effects

Measure: Brigance

Transformed Variable: Average

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	7893886.896	1	7893886.896	8974.301	.000	.991
group	9680.346	1	9680.346	11.005	.001	.124
Error	68609.598	78	879.610			

Appendix O

Statistical computation-Brigance 2

Tests of Within-Subjects Effects

Measure: Brigance 2

Source		Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
prepost	Sphericity Assumed	8419.703	1	8419.703	59.038	.000	.431
	Greenhouse-Geisser	8419.703	1.000	8419.703	59.038	.000	.431
	Huynh-Feldt	8419.703	1.000	8419.703	59.038	.000	.431
	Lower-bound	8419.703	1.000	8419.703	59.038	.000	.431
prepost * group	Sphericity Assumed	997.878	1	997.878	6.997	.010	.082
	Greenhouse-Geisser	997.878	1.000	997.878	6.997	.010	.082
	Huynh-Feldt	997.878	1.000	997.878	6.997	.010	.082
	Lower-bound	997.878	1.000	997.878	6.997	.010	.082
Error(pre post)	Sphericity Assumed	11123.897	78	142.614			
	Greenhouse-Geisser	11123.897	78.000	142.614			
	Huynh-Feldt	11123.897	78.000	142.614			
	Lower-bound	11123.897	78.000	142.614			

Tests of Between-Subjects Effects

Measure: Brigance 2

Transformed Variable: Average

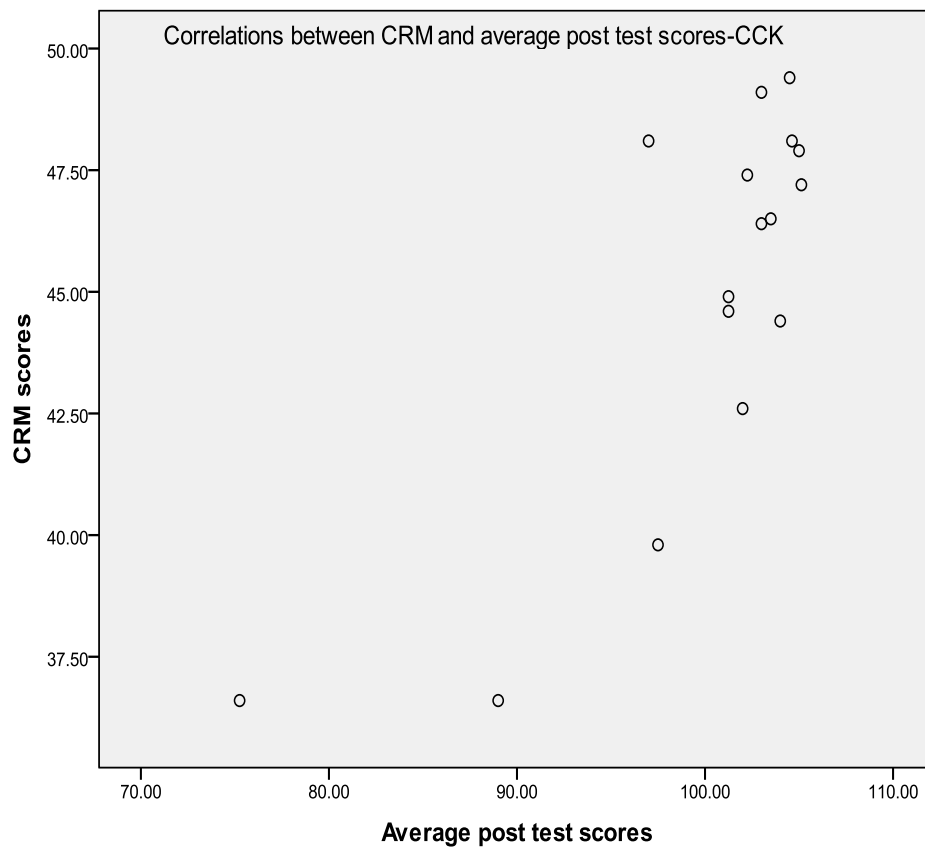
Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	1644929.420	1	1644929.420	1515.201	.000	.951
group	8768.795	1	8768.795	8.077	.006	.094
Error	84678.180	78	1085.618			

Appendix 0

Statistical Computation - Correlation between Children's Response to Mediation and average post test scores for Group 1(n=16)

Correlations		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	.803**
	Sig. (2-tailed)		.000
	N	16	16
VAR00002	Pearson Correlation	.803**	1
	Sig. (2-tailed)	.000	
	N	16	16

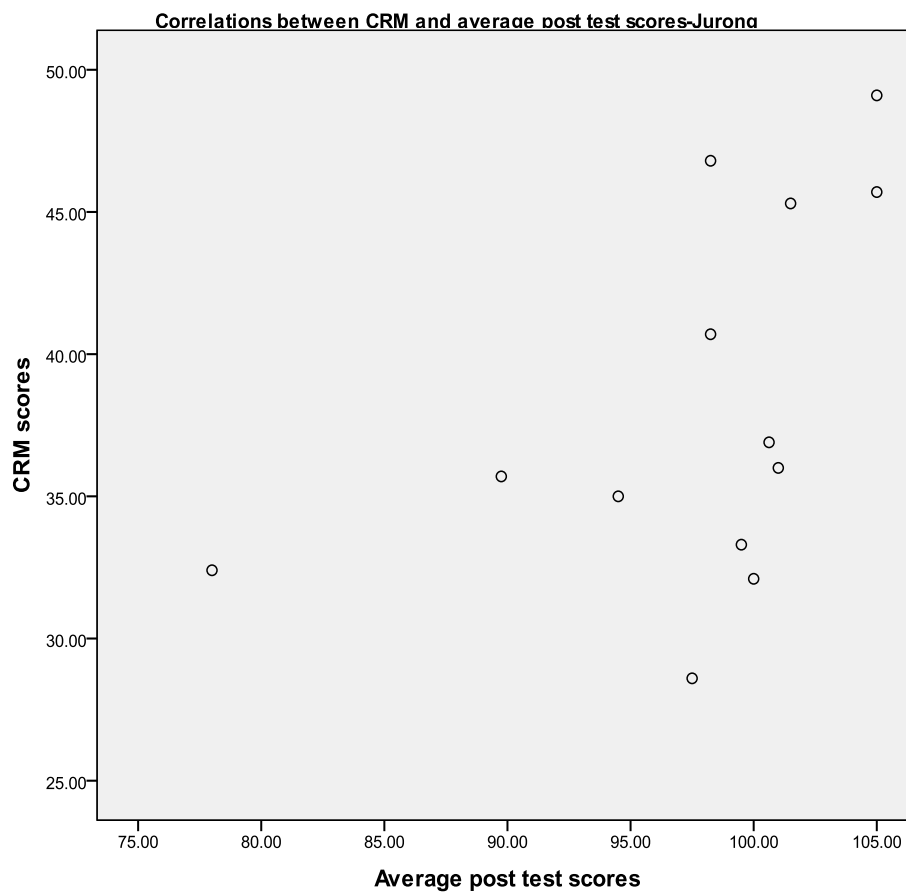
** . Correlation is significant at the 0.01 level (2-tailed).



Appendix 0

Statistical Computation - Correlation between Children's Response to Mediation and average post test scores for Group 2(n=13)

Correlations			
		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	.499
	Sig. (2-tailed)		.083
	N	13	13
VAR00002	Pearson Correlation	.499	1
	Sig. (2-tailed)	.083	
	N	13	13

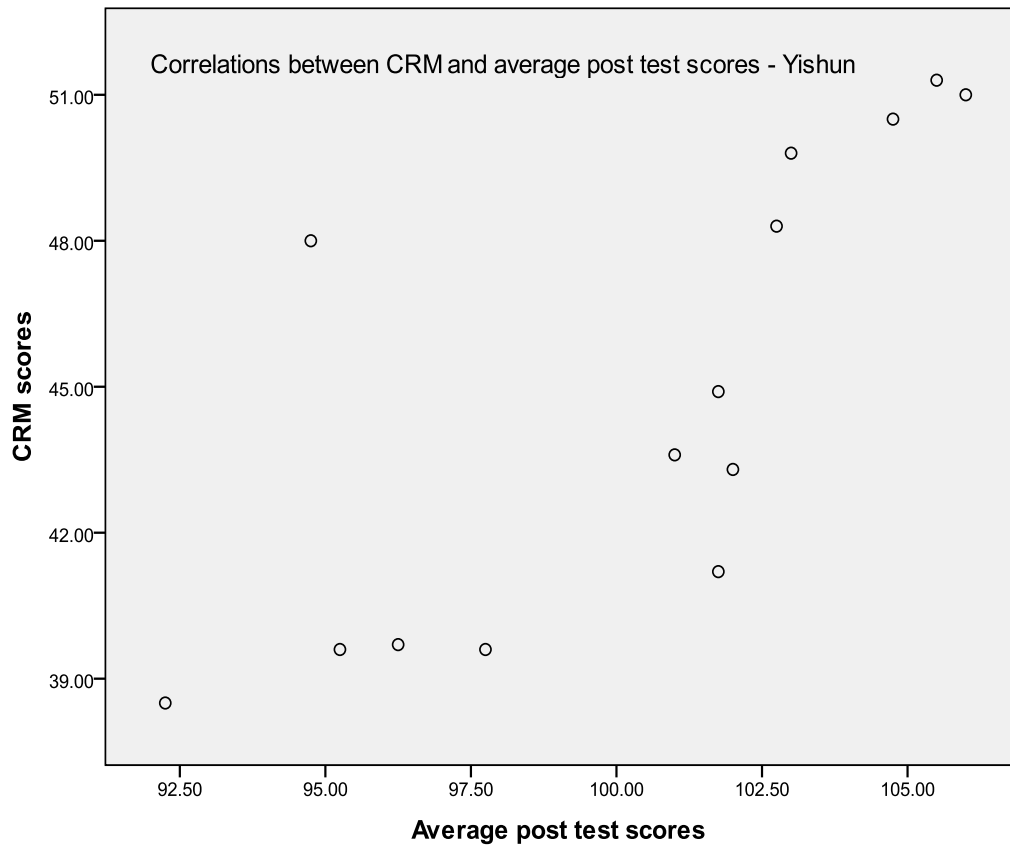


Appendix 0

Statistical Computation - Correlation between Children's Response to Mediation and average post test scores for Group 2(n=14)

Correlations		VAR00001	VAR00002
VAR00001	Pearson Correlation	1	.747**
	Sig. (2-tailed)		.002
	N	14	14
VAR00002	Pearson Correlation	.747**	1
	Sig. (2-tailed)	.002	
	N	14	14

** . Correlation is significant at the 0.01 level (2-tailed).



Appendix P

Sample consent form to participate in research study from parents

4

PARENT /CAREGIVER CONSENT FORM (FOR CHILDREN IN EXPERIMENTAL GROUP)

Research Project :

Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

I (print name) WONG AI LIN give consent to the participation of my child (printname) CHONG YAU TING of NTUC childcare (branch) JURONG in the research project described below:

Title of the research project : Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

Chief researcher (investigator) : Ms Kok Siat Yeow, email address: siatyeow@rttc-asia.com, mobile number : 65-98225192

In giving my consent I acknowledge that :

1. the procedures required for the project and time involved have been explained to me and any questions I have about the project have been answered.
2. I have read the Parent/Caregiver Information Sheet (Experimental Group) and have been given the opportunity to discuss the information and my child's involvement in the project with the teacher/ center principal and /or researcher.
3. I understand that my child's participation in this project is voluntary.
4. I understand my child's involvement is strictly confidential and that no information about my child will be used in any way that reveals my child's identity.
5. I understand that video/audio/photographic recordings will be made as part of the study.
6. the research project will commence from 1st May to 30th Nov. 2008.

Signed : 

Name : WONG AI LIN

Contact number : 98386437

Email : aileenwong@yahoo.com

Date : 25/4/2008

Appendix P

Sample consent form to participate in research study from parents

11

PARENT /CAREGIVER CONSENT FORM (FOR CHILDREN IN CONTROL GROUP)

Research Project :

Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children


I (print name) Lim Kwang Hang give consent to the participation of my child (print name) Jacky Lim Shue Bo of (NTUC childcare branch) _____ in the research project described below:

Title of the research project : Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

Chief researcher (investigator) : Ms Kok Siat Yeow, email address: siatyeow@rttc-asia.com , mobile number : 65-98225192

In giving my consent I acknowledge that :

1. the procedures required for the project and time involved have been explained to me and any questions I have about the project have been answered.
2. I have read the Parent/Caregiver Information Sheet (Control Group) and have been given the opportunity to discuss the information and my child's involvement in the project with teacher/ principal and/or the researcher.
3. I understand that my child's participation in this project is voluntary.
4. I understand my child's involvement is strictly confidential and that no information about my child will be used in any way that reveals my child's identity.
5. I understand that video/audio/photographic recordings will be made as part of the study.
6. the research project will commence from 1st May to 30th Nov. 2008.

Signed : 

Name : Lim Kwang Hang

Contact Number : 90996865 Email : _____

Date : 23/4/08

Appendix P

Sample consent forms to participate in research study from teachers

3

PRESCHOOL TEACHER CONSENT FORM (EXPERIMENTAL GROUP)

Research Project :

Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

I (print name) Ng Minp 2hu of NTUC Childcare centre consent to participate in the research project described below: (Group)

Title of the research project : Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

Chief researcher (investigator) : Ms Kok Siat Yeow, email address: siatycow@rttc-asia.com and mobile number : 65-98225192

In giving my consent I acknowledge that :

1. the procedures required for the project and time involved have been explained to me and any questions I have about the project have been answered.
2. I have read the Preschool Teacher Information Sheet (Experimental Group) and have been given the opportunity to discuss the information and my involvement in the project with the researcher
3. all aspects of this study, including the results, will be strictly confidential. The data from the study may be published and presented at conferences; however, I will not be identified by name.
4. I understand that video/audio/photographic recordings will be made as part of the study.
5. the research project will commence from 1st May to 30th Nov. 2008

Signed : [Signature]

Name : Ng Minp 2hu

Contact Number : 94308141 Email address : minp2hu_y@yahoo.com

Date : 28/04/08

Appendix P

Sample consent form to participate in research study from teachers

14

PRESCHOOL TEACHER CONSENT FORM (CONTROL GROUP)

Research Project :

Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children


I (print name) Suryani Ismail of NTVC childcare - Toa Payoh consent to participate in the research project described below:

Title of the research project : Increasing children's learning effectiveness and developing their cognitive functions : An intervention using the Bright Start Cognitive Curriculum for Young Children

Chief researcher (investigator) : Ms Kok Siat Yeow, email address: siatyeow@rtre-asia.com ; mobile telephone number : 65-98225192

In giving my consent I acknowledge that :

1. the procedures required for the project and time involved have been explained to me and any questions I have about the project have been answered.
2. I have read the Preschool Teacher Information Sheet (Control Group) and have been given the opportunity to discuss the information and my involvement in the project with the researcher.
3. all aspects of this study, including the results, will be strictly confidential. The data from the study may be published and presented at conferences; however, I will not be identified by name.
4. I understand that video/audio/photographic recordings will be made as part of the study.
5. the research project will commence from 1st May to 30th Nov. 2008

Signed : 

Name : Suryani Ismail

Contact number : 96219461 Email address : suryani@hotmail.com

Date : 22 Apr 2008

Appendix Q

Ethics clearance note

Durham University - IMP Webmail

Date: Thu, 14 Jun 2007 16:08:01 +0100

From: Sheena Smith <sheena.smith@durham.ac.uk>

To: s.y.kok@durham.ac.uk, Anita Shepherd <anita.shepherd@durham.ac.uk>

Subject: Ethical approval: S.Y. Kok

Dear Siat Yeow

I am pleased to confirm that the School of Education Ethics Committee has now approved your application for ethical approval in respect of 'Increasing children's learning effectiveness and developing their cognitive functions: An intervention using the Bright Start Cognitive Curriculum for Young Children'.

However, the Committee has asked me to convey to you, that if you intend to publish this work some journals require you to keep your primary data for five years, and not three years as stated on your application. May I take this opportunity to wish you good luck with your research.

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